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New Advertisements.

In the growth of The Electrical World in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. VIII. NEW YORK, SEPT. 11, 1886. No. 11.

WE called attention at the time to the fact that our issue of two weeks ago was the largest electrical journal ever published. That number consisted of forty pages. Last week's issue, however, was the same size, and to-day we reach even a higher point, for the present issue contains no fewer than forty-four pages. The remarkable development of THE ELECTRICAL WORLD, the almost phenomenal increase in the number of its subscribers and readers, and the absolutely unparalleled growth of its advertising business, demonstrate unmistakably that in journalism as elsewhere straightforward, capable and thoroughly conscientious work, assiduously persevered in, will be appreciated, and will bring its due reward. We need hardly add that our motto is still Onward and Upward. The paper has not reached its present commanding position on account of chance or fortune, but as the logical result of intelligent and well-directed effort. It will continue to be our constant aim to still further improve THE ELECTRICAL WORLD in every possible way.

IT is clear from what passed at Detroit last week that electric light men are determined not to be second in developing the motor business. Their "chipping in" is of the most vigorous, persistent and cheerful character. The promise for immediate work, as well as for next year, is most encouraging.

THE statistical bureau outlined in the report of Dr. Otto A. Moses, if properly conducted, would prove a most valuable addition to benefits already derived from membership in the Association. The conduction of the bureau would seem to fall properly within the province of the Secretary, who ought to give his undivided attention to it. The National Telephone Exchange Association has set a good example in this respect, and the comprehensive and valuable statistics compiled and the information gathered and distributed greatly outweigh in value the cost of their tabulation.

THE *Progressive Age*, a journal devoted to gas interests, but which carries out the spirit of its title by also paying attention to electric lighting, has the following diagnosis of THE ELECTRICAL WORLD, in its September issue:

"Our very worthy and highly esteemed contemporary, THE ELECTRICAL WORLD, is entitled to great credit for its many evidences of enterprise. It is a fair journal, and tries to be just toward all, and therefore deserves its prosperity."

We do not as a rule indulge in the reproduction in these columns of the pleasant things said of THE ELECTRICAL WORLD by our contemporaries or by subscribers, although we fully appreciate them all the same. We make an exception in this case, however, and thank the *Progressive Age* for its graceful compliment.

ONE of the most decided novelties brought to the attention of the electric light men at Detroit last week, was a 400-candle power incandescent lamp requiring only 425 watts. At least, these were the figures given in all seriousness; and the lamp is said to have been remarkably brilliant and effective. It would certainly be well to have such a lamp very carefully tested and examined. There is undoubtedly a field for large incandescent lamps, as one of the speakers said in the Convention—just where the arc light stops short, and above the range of ability of the small incandescent lamp; and we are ourselves very glad to see work being done in this direction. It will, of course, be understood that the figure of only little more than one watt per candle power does not apply to small lamps. The inventor claims it only for his large lamps, and we think he or any others working that way deserve very careful attention and considerate hearing. There is a good field and future for large and economical incandescent lamps, run, too, for long-distance lighting, off arc circuits.

THE convention of the National Electric Light Association at Detroit last week seems to have been a marked success, with good attendance, bright discussions, and a deep interest in all the various questions brought up. Although, as was natural, the absence of President Morrison was keenly felt, there was great consolation taken in the fact that he would still continue in office. We think that before the time comes round for the Philadelphia meeting, many more of the lighting companies will have wisely made up their minds that it is well for them to belong to the Association, and there are already significant indications that the work of the organization is receiving closer attention from the parent companies. As to the good done by the meetings held up to the present time, there can be no question. We believe that if the good could be stated in figures, it would be found that, as a direct result, electric lighting stations were running with at least 5 or 10 per cent. higher efficiency and success than before each member began to give the others the benefit of his experience, and the industry is but beginning to enjoy practically the benefits that can be derived from frequent consultation, strong fellowship and greater influence.

IN the paper read by Mr. C. C. Haskins at the Convention, the importance which the character of wire joints occupies in the successful and economical operations of electric lighting stations is well brought out. Hardly any one item that goes to make up success requires more attention than the line, and if this be badly constructed to start with, or allowed to deteriorate, certain loss must ensue. He shows well how a single joint of high resistance may absorb as much energy to maintain the current as the entire number of lamps on the line, and that the rules which govern telegraph line construction cannot be applied in this case. Mr. Haskins also draws attention to a phenomenon observed on an open line, which is closed by short-circuiting the battery through a relay, and then suddenly opening out. One reason suggested for this phenomenon, as he states, is that the closing of the fault is produced by mechanical action due to heat; and the other that the parts at the fault are attracted toward each other magnetically and so close the gap. Both these explanations seem inadequate, but one recently suggested appears to give the correct solution. The sudden opening out of the battery through the relay induces an extra current of high E. M. F. in the latter, which passes into the line and causes a spark at the faulty joint. The spark formed fuses the two adjacent points together and restores the continuity of the line until by vibration the fused points are again separated, when the operation has to be repeated. This seems to explain well the phenomenon observed and overcomes the objections which may be raised to the other suggested explanations.

THE legal relations of electric lighting companies to the Patent Office is a subject which very properly occupied a large share of the time of the Convention at Detroit. Mr. Steuart did well at the outset to point out that those who, from selfish motives designed to overthrow the patent system were aiming a blow at one of the most beneficent institutions of modern civilization, and that its abolishment would be a step backward toward the conditions prevailing centuries ago. The complaints which in not a few cases are justified, are not to be laid at the door of the system itself, but to its abuse. Considering the Patent Office itself, to begin with, it is well known that the force employed is lamentably insufficient to the demands made upon it, and that the salaries paid the examiners is inadequate to attract experienced men, or to keep in office those already engaged therein. Especially is this the case in the department relating to electrical inventions in which the changes taken place during the last few years have certainly not tended toward increased efficiency. Our columns have but recently borne complaint against the laxity of the Patent Office, and when we consider the vast wealth created, and the influence upon commerce exercised, by patents, it is remarkable that no concerted action has yet been taken to remedy this state of affairs. More than one report of the Commissioner of Patents has drawn attention to the large surplus in the Treasury to the credit of the Patent Office, and emphasized the necessity of increased appropriations; but Congress, so liberal in other directions, has seen fit to ignore the demand, and one of the few self-supporting branches of the government is allowed to be hampered and to become the subject of odium and reproach. The results of a system so conducted are painfully apparent in the increasing number of patent litigations. The remedy for all these evils lies with Congress, and a change will only be brought about when every one interested in the working of patented articles shall personally interest himself in securing just and adequate recognition from Congress. The manner in which this can be accomplished lies in personal appeals to Congressmen and, as Mr. Steuart points out, in the preparation of bills which shall not be pigeon-holed in committee rooms for want of "pushing." We believe that the National Electric Light Association, if in earnest, can here do a work which will not only redound to its credit and profit, but will be a lasting benefit to the country at large.

TOUCHING another point raised by Mr. Steuart's paper, namely, that relating to the establishment of a legal bureau, difficulties may here arise which seem to have been overlooked or, at least, were not brought out prominently in the discussion. Mr. Steuart seems to have taken for his model the legal bureau established by the Railroad Association, and has truly shown that its operation is a most successful one. It seems to us, however, that the conditions in the case under consideration are somewhat different. The railroads constituting the Railroad Association are almost without exception *users* of patents, whereas the National Electric Light Association is made up of a good proportion both of users and *owners* of patents. We are half afraid that the harmony thus far existing in the association would soon come to an end by the establishment of a bureau, designed principally to investigate the validity of the property claimed by a large portion of the members. True, the representative of one company, the owner of patents and a member of the Association, has manfully declared himself as willing to submit his claims to a fair judgment, but it is doubtful whether this good example would be followed by others. The active establishment of such a bureau would probably be followed by the withdrawal from membership of most of the "parent" companies, leaving the users of electric lighting apparatus alone in possession of the bureau. At present the two elements as combined in the Association are undoubtedly productive of mutual benefit, and we should be sorry to see these ties severed; but, for the reasons given above, it seems more than probable that the result would be contrary to that intended. Still another point touched upon in Mr. Steuart's able and interesting paper is the position occupied by experts in patent litigations. That expert witnesses will frequently hold opinions regarding facts which would appear to leave but one explanation open is well known, and it becomes a matter of importance to institute a reform in what is undoubtedly a growing evil. Mr. Steuart brings forward the alleged custom in the English courts for judges to call upon experts to assist them in the trial of patent cases; but if we are to be guided by the reports of some recent litigations in England, regarding important electrical patents, the court expert was not called upon to act. The idea, however, is a good one, as with the usual lack of technical knowledge displayed by the average judge an independent adviser would be a valuable adjunct to the court.

The St. Louis Telephone Convention.

[FROM OUR SPECIAL CORRESPONDENT.]

ST. LOUIS, Sept. 7, 1886.

The breath of Autumn may be cool in New York, but here in St. Louis it is decidedly hot, and as it blows on them, the telephone men from the East and North wilt perceptibly. Mr. Durant says he is trying to give us "a warm welcome."

St. Louis has been a city of peculiar interest to those engaged in telephony, for the reason that here the Pan Electric opposition has raised a bold front, and is even at the present time slightly obstreperous. However, the telephone men now convening here all seem to find it a good place to be in, and if pronounced joviality and a general air of sweet content mean anything, no great wrong is felt in a single quarter as to Government suits, subway commissions, unholy infringers and intruders, or any other bugaboo. The associate members, especially those who have gone through a sort of preliminary exercise in the rites of hospitality up at Detroit, are all on hand, many of them with exhibits that show that even in telephony, which, with its ten years' growth, is rather inclined to be patronizing of younger electrical developments, there are some things novel and unfamiliar. From the battery up to the switchboard I find new devices appealing to the business instincts of those who operate today the vast network of telephone lines in all sections of the country. There is an exposition starting on Wednesday here, and I think that the display of devices and improvements will help to throng old St. Louis for the next three or four weeks.

I spoke of Mr. Durant's "warm welcome." The local company is certainly leaving no effort untried to insure the comfort of all the visitors. To-morrow, Wednesday, it is projected to give us a steamboat excursion on the "T. F. Eckert" to Crystal City, and the time is pretty generally taken up with such hobnobbing and festive reunions natural with a set of good fellows who only meet once a year.

A great many of us have already visited the new exchange into which, since the fire and quite latterly, Mr. Durant has moved the larger part of his service. The change has not altogether been carried through yet, but when Mr. Durant took me on Monday to see how he was getting along, I was both surprised and pleased. As is well known, he uses the Law system, and has some 1,700 subscribers. In the new exchange, with improved Law boards, he now has 1,114, with about 40 toll lines, and in the other place he still has about 600. The whole system is worked with a force of only 23 operators, all told. In the new exchange a force of 15, attending to the calls of over 1,100 subscribers, make between 8,000 and 9,000 connections a day. All the new work has been carried out very rapidly under the supervision of Mr. F. Shaw. The cross-connection board, from which the wires run out up to the cupola, is a very neat and ingenious piece of work. At the time of my call the exchange presented a remarkably attractive appearance. The operators, bright and pretty young ladies, were attending to their duties in a way that indicated intelligence and discipline, and there was practically no noise. On the cross-connection board was a very fair portrait, in medallion frame, of Professor Bell, from which portières were draped back; and, at the other end of the apartment, were plants and flowers in battery jars standing on large imitation telephone receivers, shaped out of poles and painted black—genuine *megaphones*. Around the walls were hung a number of pictures, and in the superintendent's office were some clever cartoons illustrating the evils of pole-climbing and the way in which a hoarse man can talk with a deaf one, and both get mad with "central."

At eleven o'clock the convention met. Mr. Durant made the address of welcome. He was followed by President Fay, who made a long and able opening address, in which he alluded to the hopeful revival of business now stimulating telephonic activity. He ridiculed the idea of the telephone being a monopoly bent on making money by wrong and oppression, and presented elaborate figures to show that the return on the actual investment in the telephonic business had not altogether averaged more than 6 per cent., which is far below that of a great many other industries requiring large capital. He regarded the telephone not as a necessity for the poor, but as a convenience of business and social life, which those requiring the use of were well able to pay for. One highly important part of the address was that summarizing the long roll of decisions, without any break, upholding the Bell patents. Mr. Fay closed with a humorous dialogue supposed to occur between Private Secretary Dan Lamont and the President out fishing, wherein Mr. Cleveland speaks of himself as "an inspired idiot" for getting into the telephone muddle, and winds up in customary phrase by saying, "Damn the telephone, anyhow." The address created no little stir.

Gen. Barney's report was next presented, after which the following officers were elected for the ensuing year: C. N. Fay, President; Henry Metzger, Vice-President; C. H. Barney, Secretary; H. L. Storke, Treasurer; new member of Advisory Committee: H. N. Gifford, and Executive Committee: W. D. Sargent, R. M. Bailey, George N. Stone and J. N. Keller.

On motion of Mr. Metzger, Pittsburgh was chosen for the meeting next fall.

The proposed amendment to the constitution and by-laws, as printed in THE ELECTRICAL WORLD of Aug. 14, were adopted with slight change, the chief discussion being on the dues and position of associate members.

Mr. Carson reported visiting Charleston, and asked help from the members for the sufferers in that city. He and Messrs. Eastabrooke and Durant were appointed a committee to collect subscriptions. They reported later that they had secured two hundred and thirty five dollars.

General Barney then read an able report on statistics, analyzing and reviewing the proportion of telephones to population, work done by exchanges and other features.

Mr. Lockwood followed with one of his best papers, written and read in his own inimitable style. The subject was one, he said, of great importance, yet unhackneyed, as the preceding volumes of transactions would show. He discussed the various troubles for which lightning arresters must be used, and pointed to the great growth of electric lighting as a compulsion to protect telephone lines and apparatus, both at office and subscribers' ends. He classified arrester apparatus and expressed his individual preference for electro-magnetic protectors, though under certain conditions fine wires and fusible strips, as not being liable to extra current effects, had their merit. He praised the electro-magnetic device invented by Dr. Plush and used in Philadelphia, and spoke well also of what is done in Kansas City under Mr. Wiley Smith. The discussion of the paper was reserved for Wednesday.

In addition to those read to-day, the following papers are also on the programme: "Long-Distance Telephoning," by A. S. Hibbard, of the Wisconsin Telephone Company; "Legislation of the Past Year," by H. L. Storke, of the Hudson River Telephone Company; "Cables and Underground Work," by C. N. Fay, of the Chicago Telephone Company.

The business of the covention will close on Thursday.

Those in attendance up to date are as follows:

Albany, N. Y.—A. B. Uline.

Austin, Tex.—J. K. Dunbar.

Boston, Mass.—J. N. Keller, C. Jay French, T. D. Lockwood, Frank B. Knight, R. S. Boyd, T. B. Doolittle, W. A Hovey, A. O. Morgan.

Bridgeport, Conn.—Henry D. Stanley.

Brooklyn, N. Y.—W. D. Sargent, T. J. Perrin.

Chicago, Ill.—C. N. Fay, C. A. Brown, J. M. Jackson, Fred. Degenhardt, W. A. Kreidler.

Cincinnati, O.—E. V. Cherry, H. F. Crane, H. L. French.

Cleveland, O.—J. P. McKinstry, G. H. Wadsworth.

Denver, Col.—E. B. Fields.

Elmira, N. Y.—W. N. Eastabrook.

Harrisburg, Pa —J. B. Ker.

Indianapolis, Ind.—J. E. Hockett.

Kansas City, Mo.—Wiley Smith, C. W. McDaniel, E. R. Weeks.

Louisville, Ky.—H. N. Gifford.

Lowell, Mass.—J. W. Bennett, Chas. J. Glidden.

New Haven, Conn.—H. P. Frost, W. C. Smith.

New York—C. H. Barney, D. I. Carson, J. A. Seely, E. J. Hall, Jr., C. B. Hotchkiss, W. A. Childs, Frank Shaw, Geo. T. Manson, F. W. Harrington, C. C. Jennings, Geo. L. Beetle, C. W. Price, R. W. Ryan, T. C. Martin.

Omaha, Neb.—Flemon Drake.

Peoria, Ill.—T. B. Burnett.

Pittsburgh, Pa.—Henry Metzger.

St. Louis, Mo.—Geo. F. Durant, D. R. Russell, P. C. Burns.

Salt Lake City, Utah.—C. F. Annette.

Topeka, Kans.—J. R. Mulvane.

Wheeling, W. Va.—M. R. Wolff.

Williamsport, Pa.—R. M. Bailey.

Several members have their wives with them.

The Bell Telephone Company of Canada is represented at the convention by Mr. Slater.

Exhibits are being made of kerite cables, etc., by Mr. Clark B. Hotchkiss; of Roberts-Brevoort batteries, by Mr. C. C. Jennings; of a police alarm system, by Mr. W. C. Smith, of New Haven; of okonite, by Mr. G. T. Manson; of a new board on the Law system by Mr. W. A. Childs; of Waring cables, by Mr. F. Degenhardt; of Standard Electrical Works' goods, by Mr. H. F. Crane; of American Electrical Works' specialties, by Col. G. L. Beetle; of Western Electric Company's productions by Mr. F. W. Harrington, and of Railway Telegraph Supply Company's goods by Mr. P. C. Burns. Mr. C. D. Wright has also on exhibition his reducer for telephone lines for shunting bell coils.

Edison's New Carbon Button.

Mr. Edison in experimenting with the object of increasing the efficiency of the carbon button in the telephone transmitter, has devised a modification of one of his older forms, which enhances the quality of the carbon electrode considerably. One of the first forms of Mr. Edison's carbon electrode consisted of a number of fibres, each separately covered with carbon and all rolled into a wad or tuft. The latest form consists of a base of textile or woven fabric whose meshes are filled or impregnated, and whose surfaces are covered with lamp-black, plumbago, or carbon in other suitable form.

Mr. Edison has employed fine wire gauze and material woven from animal or vegetable fibre, but prefers the fabric known as veiling. A flat piece of the material of the proper size for the carbon button, and usually of circular form, is laid upon a quantity of the powdered carbon, and more of the carbon is then placed upon the flat piece. Pressure is then applied and the carbon is forced into the meshes of the fabric and fills the same, so that the fabric is thoroughly impregnated with the carbon and is covered on each side with a layer of the same For some forms of carbon a suitable glutinous or sticky material is employed to unite the carbon particles. With lamp-black, however, no such thing is required. Mr. Edison has found that carbon buttons of this character are more effective in use than those composed wholly of carbon, and thinks the reason for this is that at those parts of the button where the carbon lies upon the threads or wires of the fabric, the surface is higher than at those parts where it is forced into the meshes between the threads, and therefore the surface of the button is provided with a great number of minute raised contact points, by which better contact is attained with the opposing surface than where the button has a perfectly flat surface.

The reason that leads Mr. Edison to prefer the fabric of animal or vegetable fibre to the metal gauze is that the wires of the latter are smooth and slippery, and do not retain the carbon upon their surfaces under pressure, like the threads of the former.

Instead of the textile fabric, there may be employed a disc of thin paper perforated with a large number of small holes so thickly that its structure is similar to that of a woven fabric. This evidently may be considered the equivalent of the textile fabric. The carbon is pressed into the apertures and remains upon the surface of the intermediate paper in the same manner as above described.

The button made in the manner described is flat, and can be substituted in any ordinary telephone for the usual carbon button, requiring no binding to hold it together.

The Subway Progressing.

Work on the underground conduits on Sixth avenue in this city is progressing, and although it was expected that some interruption of the work would be caused by the serving of injunctions from owners of rival systems, no such event occurred. Although it is contemplated to lay sixty miles of conduit as a preliminary work, the Subway Commission are agreed that as soon as the section on Sixth avenue is finished, the wires along that street will be buried.

During the progress of the work the six-inch gas main of the Mahattan Gas Company was found to lie right in the way of the conduits. This called a halt until permission could be obtained to move the pipe nearer the sidewalk. This permission was granted by the gas company and the work of excavation was resumed. The pipe was laid thirty years ago. No record had been kept of its position, and the contractors were totally unprepared to find it so far out in the street. Engineer H. S. Kearney, however, was confident that not more than two blocks of pipe would have to be changed.

It is said that the Western Union Telegraph Company, in order to avoid going under ground, is negotiating with the New York Elevated Railroads with the object of suspending their wires under the elevated structures and thus doing away with the use of the objectionable poles. Regarding this matter Mr. Roswell P. Flower is reported to have said: "Under our arrangements the subways will be open to any company to lay its wires. This is just what the Western Union does not want. If they could have a monopoly of the subways, they would not oppose it. The placing of the wires in conduits such as have been provided for will be an immense lessening of expenses to the telegraph companies. It costs them now from $25 to $30 per annum per mile for the maintenance of the wires in the city. I think they could readily make a contract for the maintenance of the wires in the subways at $15 a mile and possibly less. You can readily see that it is to their advantage to use the conduits, except in so far as they must accept the use of them in competition with other companies. The question of what will be done is wholly a matter for the courts, and we are waiting for a decision on the issues that have been made up. We will not go ahead until we know what we are entitled to do."

A New York morning paper having accused Col. W. H. Johnstone, of Philadelphia, President of the North American Subway Company, of coming to New York with a corruption fund of $75,000, for the purpose of influencing the commission, that gentleman has replied as follows:

"I respectfully submit that your paper should make most careful investigation and inquiry before making so bold an aspersion as the statement therein contained, as it is absolutely false and wholly without foundation. You are clearly justified in criticising my system of conduits or subways as you find it merits. But an attack upon my personal character cannot be passed without notice. I trust that you will in all fairness do me the justice to correct the statement without delay. This is not only due to me as an individual but in justice to the high character of the gentlemen associated with me in this enterprise, whose every move and doing has been of the most exemplary character, which challenges adverse criticism.

Detroit Meeting of the National Electric Light Association.

The meeting of the National Electric Light Association was held at Detroit, on Aug. 31, under circumstances described in THE ELECTRICAL WORLD last week. The convention came to order at 12 ncon. The following list gives the names of the members and visitors in attendance then and subsequently:

Akron, O.—G. G. Baker.

Baltimore, Md.—Wm. Baxter, Jr.; P. O. Keilholtz, W. B. Krout, T. McCoubray, Jr.; C. R. Sharretts, A. Steuart.

Binghamton, N. Y.—John Anderson.

Boston, Mass.—A. V. Garratt, H. McL. Harding, E. D. Libbey, F. Ridlon, A. F. Upton.

Bridgeport, Conn.—Col. F. A. Mason, H. D. Stanley.

Buffalo, N. Y.—W. S. Frear, F. P. Little, J. C. Weber.

Chardon, O.—L. E. Parsons.

Chicago, Ill.—T. P. Bailey, W. J. Buckley, C. H. Cone, D. H. Dorsett, H. A. Glasier, C. C. Haskins, W. A. Kreidler, H. W. Leonard, J. H. Reid, J. H. Shay, Frank Stewart, C. J. Van Depoele.

Cincinnati, O.—H. E. Rich.

Cleveland, O.—W. H. Boulton, W. B. Cleveland, H. E. Cooke, J. B. Crouse, W. H. Lawrence, F. E. Pettengill, A. Pfannkuche, N. S. Possons, G. W. Stockley, W. F. Swift, J. W. Valentine, C. C. Sutherland.

Detroit, Mich.—W. F. Davidson, F. E. Fisher, W. H. Fitzgerald, W. A. Jackson, W. W. Leggett, Jno. T. Leggit, W. H. McKinlock.

East Saginaw, Mich.—H. C. Ripley.

Elgin, Ill.—Geo. S. Bowen.

Fort Wayne, Ind.—P. A. Randall.

Grand Rapids, Mich.—W. T. Powers, J. L. Shaw.

Indianapolis, Ind.—Brainard Rorison, A. S. Hickley.

Kansas City, Mo.—E. R. Weeks.

McKeesport, Pa.—Z. Latshaw.

Nashville, Tenn.—G. K. Whitworth.

New Haven, Conn.—J. English, S. J. Fox, F. A. Gilbert.

New York.—J. L. Barclay, G. L. Beetle, W. M. Callender, J. O. Ellinger, F. W. Harrington, H. Hine, Clark B. Hotchkiss, G. Manson, T. C. Martin, R. W. Pope, C. W. Price, R. W. Ryan, H. M. Smith, C. E. Stump.

Niagara Falls, N. Y.—B. Rhodes.

Norfolk, Va.—W. W. Chamberlain.

Olneyville, R. I.—R. T. Robinson.

Philadelphia, Pa.—G. W. Boyer, A. J. De Camp, W. H. Edgerton, H. G. Freese, S. Holbrook, M. D. Law, James A. Pentz, S. B. Richards, W. E. Sharpe.

Pittsburgh, Pa.—S. A. Duncan, G. F. Porter, J. E. Ridall.

Providence, R. I.—C. A. Wilkinson.

St. Joseph, Mo.—J. A. Corby.

St. Louis, Mo.—G. W. Parker, D. R. Russell, J. A. J. Shultz.

San Francisco, Cal.—Geo. H. Roe.

Savannah, Ga.—T. P. Keck.

Springfield, Mass.—J. W. Hyde.

Troy, N. Y.—F. A. Cheney, N. McCarty.

Woburn, Mass.—W. R. Kimball, M. M. M. Slattery, F. Swift.

Youngstown, O.—J. H. Clarke, R. B. Cornell.

Mr. E. R. Weeks, second vice-president, was chairman, Mr. A. J. De Camp, chairman of the Executive Committee being his aid.

Mr. Weeks opened the session with the following remarks:

OPENING REMARKS.

GENTLEMEN: Mr. Morrison sends word that owing to the sudden and serious illness of his wife he cannot be with us. To say that so popular a member of our association and so efficient a presiding officer will be greatly missed, and that he has our keenest sympathy and best wishes in his affliction, will, I feel sure, express but a small portion of our appreciation of our President. The Executive Committee has prepared a programme consisting of fourteen topics of vital importance upon which members have been chosen to open the discussion.

You do not need to be reminded of the history and growth of our association, or of the pleasure and profit derived from our meetings in Chicago, New York and Baltimore, to awaken your interest in the present convention, but it may not be amiss to emphasize the necessity for the closest attention to matters in hand, and the fullest interchange of opinions and experiences. Thus only can the maximum benefit of our intercourse be secured.

It is my further pleasure to introduce to you one who needs no introduction to some, but who desires to know you all, and to assure you of his welcome, Mr. Wells W. Leggett, president of the Brush Electric Light Company of Detroit.

Mr. Leggett expressed in felicitous terms the pleasure he felt, and that of the local Brush Company, in welcoming the delegates to Detroit. He stated that they had arranged a programme for the entertainment of the association, and announced that they had specially chartered the "City of Cleveland," the fine new lake steamer fitted throughout with the Brush-Swan system, for a sail on the river and lake, one afternoon, returning in time to see the "upper lights" burning on the towers for which Detroit has so enviable a reputation. He announced also that the company would furnish carriages to drive around town, so that the tower system might be thoroughly inspected and judged of, in every aspect.

The roll call was then taken.

Letters of acceptance as honorary members were read from Dr. Werner Siemens, of Berlin, and Mr. John T. Sprague, of Birmingham, Eng. Dr. Siemens sent for the library of the association copies of some publications from his pen.

The Executive Committee reported the order of business, carried out as below.

The secretary then read his report, showing 125 companies and individuals as members, being an increase of thirteen from the last meeting.

The report of Dr. Otto A. Moses, of the committee on the proposed bureau of information, was submitted as follows:

REPORT OF COMMITTEE ON STATISTICAL BUREAU.

A Statistical Bureau of the National Electric Light Association shall be established under the direction of a chief and under the control of the Executive Committee.

The chief of the Bureau shall receive a salary of ——.

His duties shall be to establish an office in the city of New York in which shall be kept records of all information collected from and distributed to the members of the Association.

He shall collect and classify all patents as they issue in this country and gradually do the same with all that have already appeared.

He shall examine all English, French and German patents as they appear, and shall remark on all new inventions contained in them that may be of interest to members of the Association.

He shall classify and file all patent decisions on electrical subjects.

He shall collect documents, catalogues and such statistics as may be useful in all departments of electrical distribution.

He shall correspond with all members of the Association and request from time to time information for the special and exclusive use of the members of the Association.

On application from the members of the Association he shall endeavor to procure such desired information as may be obtained from other members.

On request he shall endeavor to collect such other information as may be demanded, for which reasonable fees shall be charged subject to control of the Executive Committee, or of a sub-committee, appointed for that purpose; such information being in the nature of abstracts from scientific papers, journals, correspondence, opinions, testimony, drawings, etc.

The expenses of said Bureau shall be met by dues to be paid by the members of the Association according to the following classification:

Local companies shall pay — cents per lamp, per annum.
Supply companies shall pay $— per annum.
Parent companies shall pay $— per annum.

Mr. De Camp moved that the report be placed on file, to be taken up at some future time. They all fully appreciated the importance of such a bureau, but it involved expense that he did not think the association could now stand.

Mr. Boyer moved as an amendment that it be referred back to the Executive Committee.

Amendment accepted and carried.

The next report called for was that from the committee on tabulating rates of public lighting.

Mr. Duncan, of the committee, reported progress, and asked for more time, which was granted.

From the committee on wire gauge, Mr. R. W. Pope presented the subjoined report:

REPORT OF THE COMMITTEE ON STANDARD WIRE GAUGE.

Your committee upon a standard wire gauge, which was to confer with other associations, and advise upon the expediency of advocating state or national legislation for the recognition of a uniform guage, begs leave to respectfully report that, notwithstanding a very general expressed desire by all parties interested, that some universal standard be adopted, no steps have been taken as yet by manufacturers to bring about such a result. As the present movement in the direction of adopting a standard was originally introduced by a wire manufacturer, it was supposed that by the co operation of the various electrical associations, a general reform might be inaugurated. It is difficult to devise a gauge free from all objections, and it is hardly possible that progress can be made without the active support of the actual drawers of wire. The general tendency on the part of both producers and consumers, who desire accuracy in the filling of orders, is to furnish a sample or specify the diameter in thousandths of an inch, with further stipulations in some cases as to the weight and resistance. This practice will, no doubt, continue, even should a standard gauge come into a more general use, while in the present condition of affairs, there appears to be no other safe course to pursue.

Whatever gauge may eventually be adopted, it must necessarily be based upon actual measurement according to recognized existing standards, and consequently it appears doubtful whether the actual fractions of an inch, which are to conform with a certain number upon a gauge, is a proper subject for legislation. It is a well-established custom in many branches of trade to designate sizes by arbitrary numbers, but however desirable it might be that the products of different makers should correspond, this is not always the case. It, therefore, appears that where a size can be properly designated, based upon a legal inch, it is scarcely within the scope of legislation to fix upon an arbitrary number to represent the same thing.

This subject, wherever introduced, has given rise to lengthy discussion without material progress, and while it is entirely within the province of this association to assist in all reforms of this character, it is extremely doubtful if anything can be accomplished without the co-operation of the manufacturers, and we would, therefore, respectfully recommend that any further action upon this subject be devoted to securing their influence in actually introducing a standard wire-gauge.

He also read the letter from Mr. Welles on this subject, which appeared in our issue of Sept. 4.

Mr. Stanley knew of only two telephone companies in this country that used the new British gauge adopted by the National Telephone Exchange Association.

Mr. Harrington substantiated this statement. The matter was in such shape that practically to-day no one was using the new British standard gauge at all.

Mr. Weeks, in the chair, remarked that he used Brown & Sharp, and considered it the best gauge mathematically, and in every other way.

Mr. Boyer thought that the manufacturers were waiting for the association to adopt some gauge.

Mr. R. W. Pope explained that the Electric Light Association as a body had adopted the new gauge already. He quoted the following resolution passed at the Baltimore meeting in February:

Resolved, That the new standard English gauge, as officially adopted by the National Telephone Exchange Association, be and is hereby approved by the National Electric Light Association, for the purpose of insuring uniformity in the mutual understanding of orders between manufacturers, dealers, and consumers of wires for electrical purposes.

Resolved, That the members of this association engaged in the manufacture and sale of wires be requested to incorporate in their catalogues and price-lists the stipulation that the standard gauge approved by the above associations be understood as applying to all orders, unless otherwise specified either in quoting the prices or shipments.

Col. Beetle said it was one thing to adopt a gauge and another thing to get the members to carry it out and live up to it. They had decided to do one thing and then did not do it.

Dr. Garratt and others continued the discussion in a way that led to the appointment of Dr. Garratt, Mr. Stanley and Mr. Slattery to investigate further the wire gauge question and to compile a table to be submitted at some further convention.

Adjourned till 3:30 P. M.

The afternoon session opened with Mr. De Camp presiding.

Mr. Weeks read the following:

PROTEST AGAINST THE ENFORCEMENT OF ELECTRICAL SUBWAYS.

It is a well-known fact that for conductors of electricity air is the best insulator and earth one of the poorest. How, then, are we to account for the objections made to aërial lines, and the recent tendency to insist upon subway construction? Nine out of ten of the general public do not really care whether wires are overhead or not. If asked for an objection to so placing them, many would speak of the danger from lightning; some would characterize them as unsightly, while a more thoughtful class would note their hindrance to the fire department and the obstruction which poles offer to commerce. Some of these objections are valid, but whether all combined are strong enough to even offset those which may be urged against underground lines remains to be shown. As a matter of fact, aërial wires are a protection against lightning, instead of "making so much electricity in the air," as the common phrase runs. It is not in the city, but in the country, that most damage by lightning is done. Well constructed lines, with wires taut and parallel, or at proper angles, and with trim poles of an inconspicuous color, are not unsightly, but give to the streets an air of business. That wires do sometimes interfere with the work of the fire department, and that poles do offer some obstruction to commerce is freely admitted.

The numerous obstacles to subways may be classed as electrical, mechanical and popular—obstacles that hold against all wires, but most strongly offset those for telephone and lighting purposes. The efficiency of electrical service depends largely upon the insulation of the line and the steadiness and uninterrupted flow of the current. But underground wires, in addition to the increased and ever present danger of leakage, are seriously affected by induction and retardation, and no system of conduit has yet shown itself able to overcome all of these evils.

At a greater cost of construction, induction may be lessened; but no method yet devised has, in the least, reduced retardation, which is so vital a matter in telegraphic and telephonic communication.

The mechanical objections to underground lines are twofold—those of construction and those of maintenance. The cost of such construction is so great that it is a question whether its enforcement would not only deter capital from entering the field, but would drive most of the present companies out of business. In Philadelphia, the City Council, while passing ordinance after ordinance requiring private corporations to bury wires, exempted the city from doing likewise because it would bankrupt her. Wires for aërial arc lines cost about 1½ cents per foot, but those that are adapted to underground work range from 6 cents upward. Other items of construction are in about the same ratio. As has been said repeatedly, an electrical subway stands as a bar to its general use.

Consider the mere matter of space. Without tunneling, where shall we find a safe place for lines so easily affected as ours, under a street already crisscrossed by sewer, gas, water, and steam pipes at every few feet? If the space between these and the surface be utilized, conduits will be in greater danger from surface sewage, and liquid and gaseous leakage of all sorts; they will be subject to the constant jar of heavy traffic; and will be more seriously affected by changes of temperature. Such location, while permitting the most economic subway construction, would render the question of maintenance a vexing problem.

It may be said that these objections are urged in the interests of electric corporations only; that these corporations hold valuable franchises, and should be made to consider the welfare of the public; that if they be required by law to go below the surface, they will quickly devise methods for doing so. But in return for these franchises, electric corporations furnish accommodations that the public cannot well do without; and invention responds rather to the needs of the times, than to legislative demands.

However, there are other objections to subways that more nearly offset the public. I have designated them as "popular," though I believe few of the people have considered them.

Complaints are unceasing that gas, sewer and water construction and repair are a hindrance to commerce and pleasure, and render streets unsightly and dangerous. The frequent disturbance of city soil is a source of malarial disease of no mean importance. The necessary excavations for gas, water, sewer and steam connections are a nuisance of daily occurrence; but these connections are permanent. Not so with telephone and electric light work. It will probably be many years before a telephone or an electric lamp will be a fixture, passing from one tenant to the next as a matter of course. On the contrary, their location will be continually changing, and a frequent disturbance of malarial subsoil will result.

Again, much has been said of the danger to the public from aërial light wires. This danger is almost entirely imaginary. As such wires enter buildings from above, they are beyond the reach of ordinary traffic. But the leads to underground lines are subject to a wear and tear that will

continually injure their insulation. These wires would, therefore, not only be a constant menace to life; but, as they increase the danger of fire, would materially augment the rate of insurance.

The public is already clamoring for reduced rates for lighting and telephone service, but the greater cost of laying and maintaining underground lines would certainly prevent such reduction, if it did not largely increase present rates. In still another way will the public be incommoded by subways. Poles are now complained of as obstructions to commerce. But subways necessitate frequent man-holes and hand-holes in the pavement where wires must be drawn in and out. This is a slow process, and as extensions and alterations will always be required, there will, of course, be a constant obstruction to traffic at continually changing points.

Are not these objections, every one of which is real, sufficient to offset any and all that can be brought against aërial lines? But above and beyond these, is another that places the question of compelling the employment of subways upon the grounds of legality and equity. The whole matter of electrical subways is experimental. The New York Subway Commission reports: "The underground systems of Philadelphia, Washington and Chicago were personally examined by us during November, 1885, or rather such *embryo* systems as there exist." From Philadelphia comes the statement that that city "has arranged a *test* for 11,550 feet of underground wires to illustrate the practicability of such a system." Yet every one knows that the cities mentioned have the largest per cent of underground wires.

That electricity is an invaluable aid to commerce is now almost a truism. Yet few of those not immediately dependent upon it for the transaction of a great part of their business, realize that commerce would stagnate without its modern applications. Business men fully recognize that anything that interferes with the best electric service, equally affects the safety, rapidity and convenience of commerce, and, therefore, is not to be lightly held, and that only the most weighty objections to present methods are worthy to be considered. So fully is this realized, that all commissions appointed to inquire into the expediency of various new demands to be made of electric corporations have uniformly recommended caution and slow procedure, that the important duties of the telegraph, telephone and electric light companies be not interfered with.

There has been much newspaper talk as to the danger of aërial lines; and much has been said of the large extent of underground wires in various cities, and public attention has been so generally called to the subject that many cities have been led to suppose that there is an immediate necessity for burying all wires. The result is that a great deal of hasty legislation has been indulged in with very little consideration of the knottiness of the problem involved, and the great expense to which a most valuable industry would be put.

To quote again from the New York commission: "The difficulties which surround the successful solution of the underground wire problem in this city are of an extent and magnitude of which the public, as voiced in the general press, at least, have no adequate comprehension."

The adaptations of electricity are comparatively modern, electric lighting being but in its infancy. Almost everything in regard to the details of the work is experimental. Difficult as is the problem of a satisfactory method of burying telegraph wires it is greatly complicated for telephone and electric light lines. That any conduit will operate successfully for our business has not yet been shown. The percentage of wire now under ground is small. In New York, where there is probably more than in all other American cities combined, it is about 6 per cent.

How, then, can the matter of subway construction be anything *but* experimental. That it is so is abundantly proved by the reports of all who have investigated the subject. The reports and contracts of the New York commission are full of clauses that show this conclusively. The most vital questions are left to be settled as the work progresses, because no one has the practical knowledge to settle them beforehand. There is no question that wires may be made to work under ground. All electricians admit this; and many large corporations have made extensive experiments with a view to securing some feasible subway system. But, as yet, the question how to make them work *satisfactorily* and at a *reasonable cost* has not been solved.

In view of the existing state of subway experience, how can any legislation, looking to the forcing of all wires under ground, be equitable to electric interests? The first investments for the electric lighting business are large; unexpected outlays are frequent; the life of the apparatus is unknown; and the improvements that are constantly being made necessitate many costly changes. All these facts protest against hasty legislation whose enforcement would practically prohibit many of the small beginnings so valuable to new industries.

There is another phase of the question that has as yet received little consideration. Electric companies have a large amount of costly apparatus that would be rendered useless by a wholesale enforcement of subways. Whether they can be compelled to bear this loss, in the present state of knowledge as to underground work, involves a legal point not yet settled. In fact the best legal advisers deny the right of a city to require any corporation to bear such loss, especially at the risk of unsatisfactory service. When some underground conduit has been devised that is practicable from electric, mechanic and economic standpoints, and that the people believe to be more desirable than overhead wires, there will be no need of legislation in the matter, as electric corporations will hasten to avail themselves of whatever promises best for their customers.

In view of the fact that subway lines have not yet been shown to render as reliable service as aërial ones; as the objections to them will be much greater than those now urged against the present method of running wires; and as the legal phase of the matter will involve cities in useless and expensive litigation, it seems wisest to hold the whole matter in abeyance, until the important tests about to be instituted in various localities, notably in New York, have resulted in the discovery of some underground plan that will give satisfactory service to both producer and consumer. This is the course of equity.

Mr. Pope said that the arguments so freely used against the underground idea, by the companies interested in aërial wires, were now being brought out by the underground people themselves in quarrels with each other. He instanced the recent litigation in New York over the award of the contract by the Subway Commission there to the Consolidated Telegraph and Subway Company. One of the complaining subway companies urged that it had already spent $25,000 in preliminary work, under its supposed privilege. Here was proof that if it was wrong for one company to lose $25,000, it was a still greater wrong for a company operating wires to lose ten times as much. They all knew that some of the electrical companies in New York had available underground plants which would be practically thrown away when their wires were placed underground in a combination system. This was one of the most serious questions connected with the subject. A company also having invested $100,000 say, in aërial wires, would be obliged to abandon that and invest as much more in order to meet the requirements of the law. That was a hardship, and whether anything would be done to remedy it was not certain. Mr. Pope then mentioned the Western Union subway from 195 Broadway up to its office at 23d street. The company had been blocked in its underground work, generally, because it could not get permission to place its wires underground independently through Twenty-third street down to the Third Avenue Elevated road, along which the wires would then be carried out of the city. Hence the same progress had not been made, as far as that company is concerned, as would have been if the commission in New York had not been established. The present system adopted for New York was a combination one of various patents and plans placed before the Commission, out of 119. The day he left New York work was to have begun excavating the first subway from the corner of Twenty-third street up Sixth avenue, but he had not heard what had been done. As to the dissensions between the various companies which had been endeavoring to secure the contract for doing the work, they were such that the burden of contesting the scheme was taken off the hands of the aërial people altogether and transferred to the underground companies themselves, who were certainly fighting more vigorously through the newspapers or the courts than ever the aërial wire interests fought the underground people.

Mr. Haskins then made a statement as to the number of miles of conduit and wire therein in Chicago, and explained some of the points in regard to the well-known system in use there for public and private wires. He took his figures from a paper on the danger of electric light wires and the underground system, read by Prof. John P. Barrett, of Chicago City, electrician and superintendent of city telegraphs, before the National Association of fire engineers at Providence, on Aug. 24. "Outside of the city wires there is now controlled by the Chicago Sectional Underground Company a system consisting of about 17 miles of conduit with 150 miles of wire, which includes all the electric light wires. By the Western Union, 10 miles of conduit with 150 miles of wire; the Chicago Telephone Company, 3 miles conduit with 200 miles of wire; Bankers and Merchants, 15 miles conduit with 400 miles of wire; Postal Telegraph Company, 4½ miles conduit with 100 miles of wire: Baltimore and Ohio, 2 miles conduit with 50 miles of wire. Our municipal system, exclusive of the city electric light wires, consist of 63½ miles of single wires laid through 7,931 feet of conduit built and owned by the city. In addition there are 20 miles of single wires laid through 4 miles of conduit owned by the Sectional Company; 10 miles of single wires placed under the sidewalks in the central part of the city; 1,955 feet of wire in 840 feet of iron pipe and about 1½ mil s of cables under the river at Archer avenue and Chicago avenue, Division street, Clybourne place, and through the Washington and Lasalle street tunnels."

"The conduit owned by the city is a 9″ concrete pipe leading from the City Hall to Lasalle street, and branching from there to the north side, ending at Huron street, to the south ending at Harrison street, and to the west side ending at Clinton street with manholes 44″ in diameter and 5 feet deep for the purpose of testing, drawing in and out, &c.

"In the Huron street branch we have 20, in the Harrison street 20, and in the Clinton street branch 42 wires leading to lightning arresters at each end, and from these points the air lines diverge, covering the northern, southern and western districts of the city. In the manholes we have testing boxes made air-tight with screw heads and rubber gaskets. If we have trouble on one of the lines we can locate it between two manholes, draw the faulty wire out and a good one in. The wires in this conduit were put in service in August, 1884, and have not given us any trouble since." Mr. Haskins, while admitting the seriousness of the question of abandoning an aërial plant, said that if he were building new lines he would prefer to go underground. Wires once put under would remain there in better shape than if put overhead.

Mr. Pope then gave a few details as to the underground plan of "drawing in" subways adopted for New York and Brooklyn.

Mr. De Camp thought there was less antagonism in this matter than before, and that the outlook was encouraging for a final solution that might prove satisfactory to both parties concerned. He called attention to the fact that in Philadelphia, the City Electrical Department, with sanction of the authorities, was making trials with arc lights on about 11,000 feet of underground system. The city had thus shown a sincerity in this matter, wanting heretofore, and that promised a better understanding. It was beginning to be appreciated that there was a good deal of point in the objections raised by the aërial wire interests, and, on the other hand, with the system shown to be practicable, the aërial companies would undoubtedly be governed by the results. Altogether, Mr. De Camp took a far more hopeful view on the subject than heretofore.

Mr. Haskins said that in some towns of the State of Illinois it was the practice to look on the sidewalk as a portion of the street; and in some, not; and difficulty arose as to the limit of the fee simple of the party owning the property abutting on the sidewalk. Many such people thought if they could get a dollar or two out of an electric light company it was not a bad thing to have.

Mr. De Camp emphasized his view that whenever they came to adopt an underground system in cities, it must be a general system including and embracing all the wires. And, moreover, he did not want to put his wires in a conduit unless it was in the charge of an entirely disinterested party, so that there would not be the slightest chance or possibility of favoritism or of any tampering with the wires.

Mr. Roe thought it would be well as influencing public opinion to print and circulate the protest in handy, small form. The suggestion was discussed, but failed of adoption.

Mr. Corby being asked for his experience said that so far he had been let alone at St. Joseph, and he was willing to let the matter stay there—without raising the question.

Mr. T. C. Martin then read a paper on

SOME FEATURES OF INCANDESCENT LIGHTING AND WIRING.

In bringing to your attention a few remarks on incandescent lighting and wiring, it will be of interest to note that at the first meeting of the Association the first subject on the programme was "incandescent lighting." It seems to me wise that the subject should have been given such prominence. The arc light is to many of us a main object of concern, as it is a main source of income; but, after all, as Dr. Otto A. Moses pointed out so forcibly at our New York meeting last September, the arc lighting field, when wholly covered, is but 5 per cent. of the possible area over which electric current can be utilized for illuminating purposes, in cities and towns, to replace gas, oil and candles. We are even told by some that even in its own special and peculiar sphere of occupation—that of street lighting—the arc lamp is to give way before large incandescent lamps disposed, as are the gas jets, on short, ordinary posts. That may be, though I hardly expect to witness a complete change yet awhile. I know of few more cheerful or beautiful sights than the tower, like a "radiant sister of the day," as Shelley phrased it, holding aloft through storm and calm its torch of living fire; or the long lines of steadfast white stars that now begirdle and illumine nightly the finest thoroughfares of our most progressive cities. Those lights have come to stay, little as the Hickenloopers may be willing to admit it.

Meantime, the incandescent light is rapidly gaining ground, leaving its more robust brother outside, for the present, as a most unquestionable cock of the sidewalk. At the Baltimore meeting last February, Mr. De Camp summed up the situation in regard to indoor lighting in half a dozen highly significant words. He said: "The incandescent light is popular. It is growing in popularity. It is most popular among the business people." That being the case, there has been a general desire on the part of arc lighting companies to meet the demand that comes to them for both forms of the light. To the public, the electric light still means either arc or incandescent, indifferently, to be ordered at the same station, just as one would order butter and cheese at the same store counter. One effort to meet the new requirement has been made in the supply of incandescent lights on arc circuits, run from distributing boxes; and while that method is characterized by many practical men as a craze, and by others is regarded as still in the stages of experiment more or less advanced, it has the recommendation of filling a gap. Some companies are trying the system with success, while others, with deeper purses or fortified by the courage of their convictions, have put in already separate plant for incandescent lighting, and are running independent circuits for it. At the beginning of the present year, about sixty arc companies were operating incandescent lights as a regular and large part of their business, and from what I can learn, the number has doubled since then. In a few instances the old arc company has formed a new organization to handle the incandescent lighting, a plan that has its advantages, perhaps, although concentration of plant and unity of management generally result in economy and larger dividends. Sometimes the local gas company has itself kindly relieved the electric light company of worry on this score. Altogether, the late remarkable development of the incandescent field is, I venture to say, well worthy the consideration of the association in its assemblage to-day.

Professor Thurston recently took occasion to point out that in his well-known historical review of the evolution of the steam engine, he had distinguished three periods of growth: that of speculation—by which he meant theorization, not stock-jobbing; next application in a great variety of distant forms; and then a period of refinement in details. I cannot but feel that in incandescent lighting we have reached analogously the last of these three stages, in which success lies largely with the adaptation of means to ends, and the care with which simplicity of system is combined with elegance of apparatus. The chief elements of operation are now well ascertained and determined. We have dynamos of high efficiency giving us currents of constant potential, we have lamps steadily gaining in life and candle-power, and through the meetings of the Association we are quickly learning the best methods of station equipment and management. But, so far, little has been said in public or in print about wiring, in connection with which many important "details of refinement" have still to be settled; and it may not be amiss, therefore, after the survey just taken, to direct attention to this subject briefly. My own interest in the matter has been aroused by an inspection of some of the work done in New York, especially that of Mr. Augustus Noll, of the firm of Noll Brothers, who have put in probably more than 50,000 lights for the Edison Company, the confidence of which they deservedly enjoy. From the fact that the Edison Company has lately abolished its wiring department and turned over the work to this firm, I cannot but infer that the methods adopted have been such as to reflect great credit on the Edison system wherever thus installed. A glance at those methods, then, will perhaps be beneficial and suggestive.

Mr. Noll is an enthusiastic advocate of the "distribution" system in wiring as compared with the "circulation" system, and I am free to own that the little study I have been able to give the subject almost persuades me, too, to be a "distributionist." A definition of the two systems, or rather a statement as to their differences, may be attempted here. "Circulation," regarded broadly, consists, for instance in a large building, in running the main wire clear through from the dynamo to the last floor, and at each floor taking off a feeder by which in turn the lamps there are supplied. Now, according to Mr. Noll, a system of this nature is very difficult to manipulate. You have naturally a large loss between the first lamp and the last, and the only way to get equal candle-power on each floor is to put in lamps of lower voltage the further they are removed. But the lower the voltage of the lamps, the less economical does the system become; the heat units on the line are increased, warming up the conductors undesirably, and as some of the lamps nearest the machine will be run above their candle-power, there will be abnormal breakage. Moreover, if the building have great depth, the lamp furthest from the main on the same floors will show a drop in candle-power as compared with

the lamp on that floor nearest the main. Besides, in testing for grounds and leakages, much cutting and time are required to locate the trouble, especially where, as I have known to be the case in some large installations, as many as fifty or sixty lights have been placed under the control of a single switch.

Turning to the "distribution" system, as recommended so enthusiastically and employed so skillfully by Mr. Noll, it would appear that a plant, no matter how large, can be wired in such wise that the loss or drop between the top floor and the basement will be as inconsiderable as only one or two volts. The idea is to wire to centers, or distributing points midway in the installation, thus equalizing the pressure on all parts of the conductors, and making it possible to use the same volt lamp in the plebeian dive, the luxurious parlor and the journalistic garret on the seventh floor. The wires are so arranged, too, that any portion of the system may be individually disconnected and tested, and hence the cutting of wires and damage of floors and ceilings can be avoided or minimized where the wires are concealed from sight. When the building is very large, it is advisable to run two or more main feeders, as by using only one the distance from the distributing centre will be great enough to increase the drop on the line. For other reasons, too, it is always preferable to have more than one main feeder. Should any mishap occur with dynamo or engine, you can throw off one section of the building or throw in another dynamo, or where both machines supply together, leave one with lightened load. A further advantage of frequent distributing points is, that all safety devices, such as cut-outs, switches, etc., are located on each floor in one known place or more, easy of access to those in charge; whereas in ordinary "circulation" they are placed in all parts of the building indiscriminately. To give two examples of Mr. Noll's methods: I found that in the new Astor Building, in Wall street, a structure of great depth, he has three main circuits on each floor, with the switches and safety catches in groups of five in definite locations within the hallway paneling. Hence he could test out trouble down to any group of five, and then go without the least delay to the box revealing the actual fault. In the Central Park Plaza Hotel, where more than 3,000 lights are being installed, Mr. Noll has five main feeders connecting with five switches and boxes on each floor. The boxes are placed in the hallways just at the top of the wainscoting, and while in nobody's way, can be got at immediately. It is evident that by locating all the control devices in lock-boxes in the hallways, in hotels or apartment houses, you do not inconvenience any occupant of a room. If trouble arises, you go direct to the box concerned and test from that point. If the plant is in a large mill or factory, the employés, prompted by that insatiable curiosity at once the blessing and bane of our nation, are very apt to meddle with the apparatus; but by having the boxes placed regularly, with the safety and switching devices therein under lock and key, much annoyance will be avoided. The employés may not approve, but the electrician in charge will rejoice.

So much for systems of wiring. There are one or two other "refinements of detail" to which Mr. Noll has directed my unpracticed eye, that probably have won your notice also. One is the fact that too often small tap lines are run anyhow, and thus present as labyrinthine an appearance as a map of Boston or the maze around Rosamond's bower. Now in this respect, we can learn from our friends, the enemy. Some day, in the good time coming, the gasfitter will rank with the dodo as an extinct animal, and the combination fixture will be preserved in museums next to the flint musket and the clock wound by hand; but as nothing exists without its lesson, it is well to remember that piping has been reduced by the gasfitter to a system that is at once sensible and effective. Following the gas precedent, then, as to mains, though not as to meters, main wires should always be in wonted places, and all tap wires should run at right angles. Architects are, I believe, fully informed as to the manner in which gas pipes are placed in houses, but often the ways of wiremen in running lines haphazard are as inscrutable to them as the ways of Providence or the votes of a board of Aldermen. If a regular system, mechanically, of wiring were to be universally adopted, there would be no trouble in telling just where a defective line ran; and then it would not be necessary, when wanting the information in a hurry, to hunt up the man who did the work and has a weak memory.

The advantage of running tap wires at right angles and from familiar points is the more appreciated where those wires are concealed completely. This matter of covering up wires is another point on which the Association might well utter an official opinion. In the new buildings on which he is at work, Nr. Noll has all his wires out of sight, in the walls, under the plaster and the woodwork. The effect is admirable. Yet it was but the other day that the President of a parent company in the incandescent field expressed to me his decided preference for wires in sight, that being in accord with modern architectural and engineering practice as far as he was acquainted with it. He liked moldings; while another active worker in incandescent lighting told me not long ago that the sight of a molding on a wall for wires was abhorrent to his ideas of beauty and seemliness. Perhaps uniformity in this respect will not be reached until, as will soon be the case, all buildings are wired from the start.

Then they will be, I think, in the walls and under the floors, as are the gas pipes to-day, although the steam-heating pipes are undoubtedly more in sight than they once were. So far, one may contend, it has been something in substantiation of the honesty of the wiring done that it has often been left to be observed of all observers. In fact, as the politicians are the most successful of wire runners and are generally anxious and desirous to keep their leads well out of sight, the inference might fairly be drawn that electric lighting has little to do with municipial politics.

There are some places, however, where wires are necessarily strung in full view, such as breweries, dye-houses, stables and like establishments, in which the air is very damp or is laden with acid vapors. I notice that Mr. Noll makes a practice in such cases of using good insulated wire suspended as much as possible, using a minimum quantity of insulators or fastenings. This should be, as perhaps it has already become, a generally adopted method.

And now, fittingly, one or two words as to the underwriters' rules and regulations. In New York it is required that wires should have 2½ inches space between them, or not less than half an inch of some solid non-conductor, such as dry wood. When the work is finished, the company or contractor notifies the Board, and an inspection is made. Now the work may be seemingly good, but should that dry wood become wet, a not unlikely contingency, any defect or shortcoming in the work would soon manifest itself unpleasantly. Again, in a new building, where wires are laid under the floors or imbedded in plaster, the contractor can in reality use any material he pleases and run the wires as his fancy or convenience dictates, for when the inspection occurs, after the work is finished, the underwriters' man has to depend rather on the evidence of his ears than of his eyes. The wires being concealed, the inspector can only know of their position and condition by some intuitive process. To step in at so late a stage is rather superfluous.

Moreover, there is a want of uniformity in system. In New York the underwriters depend for safety on the distance apart of the conductors, while in Chicago, I am informed, they depend chiefly on testing the resistance of insulation, which, not unlike the little girl of history, may be "very, very good" at one time, but decidedly "bad" and "horrid" at another. In New England, as I understand, samples of wire are given to lighting companies and wiring contractors, accompanied by rules as to which should be used and as to the nature of the workmanship. In that section more has been done, I believe, than anywhere else to secure good, honest work. Still, in a comparatively new industry there will be frequent opportunities of evasion. It is suggested by Mr. Noll, in reply to my queries on this point, that in all large cities and manufacturing centres, an intelligent, trustworthy inspector be appointed, having the necessary qualifications to judge of proper mechanical and electrical construction. Then, when a building is to be wired, notification of the fact should be sent in, with samples of the wires to be used. At the time fixed for starting, the inspector should be in attendance to look over the building and offer suggestions, and from that time the work should have his supervision so that he can satisfy himself as to the standard quality of material and work. On completion, the inspector could at once issue his permit. I am not greatly in favor of inquisitorial methods of keeping mankind straight, but it is not impossible that a plan of this character would do much to raise the quality of the work, secure satisfactory operation of plant, and give greater stability to the whole business. Or, as an alternative, the step might be taken under the auspices of this Association, of examining and certifying or licensing those who do the actual wiring. This is the practice with steam engineers and plumbers, yielding excellent results, and it might go far toward securing the users of electric light against inferior and dangerous work. Nothing is good enough until it is as good as it can be.

It was voted to reserve the discussion of the paper until the morning.

Before the meeting adjourned, Mr. Leggett, to meet a question that had been put to him very generally by the members, said that the towers in Detroit were lighting 21 square miles entirely from one station. One circuit was 20 miles in length, and had fifteen towers on it. There were 122 of the towers, nearly all of 4 lights of 2000 c. p. each. There were 78 low pole lights, but quite a number of these were not placed with any special view to lighting the locality. There were 576 city lights in all. The towers stand on one leg only, and are 150 feet in height. With three legs to the tower, they found climbing boys a nuisance. The streets were lighted all night and every night in the year. The citizens were strongly in favor of the tower system. The annual city contract was $114,500.

Adjourned till 10 A. M. Wednesday.

The session on Wednesday morning opened with the discussion of the paper on some features of incandescent lighting and wiring. Great interest appeared to be taken in the matter, and the discussion occupied about two hours, ranging over all the points touched upon.

Mr. Cheney said that his company had not found much advantage in running incandescent lamps on arc circuits. He thought it to be a dangerous practice to run wires under floors, etc., and made a strong plea for the use of moldings.

Mr. Ridlon said that it was thought by their insurance people that an air space with the wires in sight was far better and safer than any molding whatever. If they were to have a molding, they should have one that was fire-proof and proof against dampness between the molding and the wall.

Mr. Rhodes said that at Niagara Falls they were using water power, and had a good many Swan lamps running very satisfactorily from their Brush arc circuits. These incandescent lights were used in connection with a Brush box, both 38 and 92 volts. Some of them were located several miles away from the station, some of them over in Canada. They crossed the river twice with their wires, but not under water. "We do not use barrels for the protection of our wires, either, but they cross on one bridge and come back on the other. One of our circuits is 12 miles long. We find no difficulty whatever in using these lamps at that distance from the dynamo. But I have come to learn more about wiring. Our wiring has been done by men who have grown up in the business with us, and the only lessons they have had have been the lessons of experience. The question of wiring is a serious one, and one on which I with a good many others, need instruction." In reply to questions, Mr. Rhodes continued: "We are running, in the usual way, seven 38 or sixteen 92 volt lamps from these distributing boxes. I am sorry to say we have not had any way yet of keeping a record of the life of the lamps thus run, in hours. We run our lamps either for all-night business or for half-night business, and those who run for part of the night are permitted to burn their lamps until 10 o'clock in some cases; those lamps burn all the way up till 10, 11, 12 and 1 o'clock. With a number of boxes, I suppose the average burning will be from one hour before sunset until 10 or 11 o'clock at night. We keep account of our breakage, not by hours but by the month. We find that for the last three months our breakage has been 3 lamps per month, to each set of 7. For some reason or other not quite clear to us, the breakage is becoming less and less. The longer we use the lamps, the fewer give out. Whether the manufacturers are making the lamps better, or whether we are learning to run the dynamo more steadily, and to keep our current more regular, I am not prepared to say: but certainly we are gaining in that respect. Thus the breakage will now be about 2 per month, to each set of 7, which would be 24 in a year. Any one can figure out the expense of that, and will find that it is not a remarkably serious item of expense, as this is practically almost the entire expense of running. How this would be varied by running by steam I am not prepared to say, but I believe that as we run by water-power our current is much more regular than it can be made by the best steam engines; and, I believe, that in that respect we have an advantage over steam engines. Another point is, our expense is so very little on other items that we consider this breakage to be our principal item of expense. Our entire cost for horse-power is $15 per h.-p. per year, including the rent of the building and the installation of the wheel. We do not own the wheel, but rent power. As the power required for seven 38-volt lamps is considerably less than a horse-power, the power expense is very small indeed. The expense also of the men who take care of these lamps is very small indeed, because it is delegated to the lamp trimmers and occupies very little of their time. The success with us is so great that it is at least satisfactory. The lights are satisfactory to our customers, and the prices are as satisfactory to us as to them."

Mr. De Camp: You speak of a breakage of two lamps per month for a group of seven. That is the 38-volt lamp. Does the same rule apply to the 92 in groups of sixteen?

Mr. Rhodes: We have not had enough experience yet to strike an average. On the two sets that have been running a few months, our breakage has been considerably less in proportion. That may be because we have not yet reached the life of the first lamps we put on. I think that on our three sets for three months, the breakage has been only about 2 per set—only about the same number in the sixteen of 92 volts as in the seven of 38 volts. The 16 c. p. lights easily take the place of a 5-ft. gas burner. They are run on the same circuit as the arc lamps, but we have been advised that if we put our entire number of incandescent lamps in groups, on a circuit by themselves, the breakage would be still less. But we cannot do that without doubly covering our entire district, and we prefer to continue doing as we are, with a single system of wiring covering our entire territory, sandwiching in among our arcs the incandescents, just as they happen to come.

Mr. De Camp inquired as to price compared with that obtained for the arc lamp displaced by the group.

Mr. Rhodes: We charge in all cases $1 per month for each incandescent lamp. We get $7 for each set of seven. Where we put in the sixteen we make $1 reduction, leaving the charge $15 for the sixteen lamps, a slight inducement to the customer to take the additional number. We add 50 per cent. to that for lamps that burn all night. For arc lights we receive $8 per month, single lamps, and $10 double lamps. In some cases we find that we have been obliged to substitute the incandescent lamps for the arc, whether we wanted to do it or not, and I believe that has been found to be the experience of others, as already stated. There is a call for incandescent lamps, no matter how well the arcs burn—and ours burn as well as anybody's. Nearly all the customers who occupy small stores, as is the case in small towns, and to a great extent in large towns, prefer the incandescent lamps to the best possible arc lamp in existence. We find that there is a call for these incandescent lamps from those who have been using arc lamps. We find that there is not a very great difference between the profit of one and the other, and we try to balance one against the other at those prices which I have named. We are very much pleased to substitute the incandescent lamps for the arc. We try to fix our prices so that it will be as satisfactory to ourselves in one case as in the other, and then we let the customer make his own selection.

Mr. Weeks: Do you furnish the wire and fixtures, or charge that to the patrons?

Mr. Rhodes: That is a question that has come up several times—what to do with fixtures. At the present time, we are in a transition state, I may say, looking for advice and trying to learn from experience and that of others. We have not yet arrived at any conclusion. I think the one we will arrive at will be to insist on having everything done well, and, if necessary, to put in our own fixtures. We will put in a fair fixture, not an extravagant one, and adopt two or three different styles. We will put in such for you at our own expense, doing the entire work and paying for it ourselves, not charging the customers either for the wiring or for the glass globes and shades in connection. This point of charging for fixtures has become a serious one in cities where there is a good deal of competition, and in order to get the business one company and then the other will make sacrifices, and hence the companies have come to do all the work themselves without any charge to their customers. Of course where there is only one company, and that has all the business it can get, it can make the charge against the customers what it pleases. In small towns like our own, where it is necessary in order to get a large amount of business to make some sacrifice, it comes to be nearly a necessity to do the thing yourself. That is a matter to be judged of in each community separately. We believe that in the way we propose to adopt, we can get our wiring done more satisfactorily to ourselves, and that we can obtain a sufficient additional number of customers to make it profitable to ourselves. We have had quite a little trouble from poor wiring and from hanging incandescent lights with poor fixtures. We find that it will pay us to furnish proper fixtures, even if they are combination fixtures, having them well insulated and the incandescents properly attached.

Mr. Ridlon: How long a time do you make a contract with your customers?

Mr. Rhodes: For a year. But we have come to the conclusion that whether a customer signs a contract or not it is rather immaterial, because if we have a customer who is dissatisfied with his lamp from any reason whatever, it is much better for us, if such a case should happen, or for any other company, to take the light out immediately and release the man from his contract than to insist upon his using the light against his will until the close of the time. It is better for the company to see in the first place whether the man will continue; and if he is not likely to continue, it is best not to put in the lamp at all. There are a great many such cases where arc lamps have been forced into stores and saloons, where they were not at all appropriate. I have known cases where contracts have been signed and the customer forced to use the light, when the contract ought never to have been made at all. We believe that in such cases it is better to discontinue the light entirely.

Dr. Garratt said he did not believe that with any system of light, whether electricity, gas, kerosene or candles, the party supplying the light should be called upon to furnish the fixtures, too. Any man wishful to have the light was willing, he thought, to pay for wiring and fitting up the house. It was thus with gas, and he did not see why an

electric lighting company should not be similarly disposed.

Mr. Duncan wanted to know who stood the breakage of the lamps.

Mr. Rhodes: The company, I suppose, in all cases furnishes the incandescent lamps, when breakage happens. Certainly our company does.

Mr. De Camp: On the question as to who should repair the lamp. If they charged the customer with half the breakage, that seemed to be equitable. He thought that a company with a number of these lights on an extended system and entirely responsible for the breakage could not afford to neglect them, and that the attendance on them to the extent of inspection would be very nearly equal to that on the arc light. If, however, the parties using these lights knew that when broken the lights were to be replaced at their expense, they would undoubtedly take better care of the property than if the case were reversed.

Mr. Gilbert said that in New England they had been running 125 c. p. lamps on the arc circuit for about three months. They had not believed in it before. They now found they could use them in multiple series without the box, and could certainly get three of them for less than a box would cost. They made their estimates as to the necessary life of lamps, and as to the price that should make them willing to displace the arc. If the lamps lived 400 hours they were going to put in more. Next convention he would know and tell the difference found in the profit on that basis. For some of them the average time now is 500 hours. They were getting a great deal longer life than they estimated. If the lamps lived 100 hours, they would still get their money back, but not make any profit. He found there was a field for the large incandescent lights just below where the arc lights stop, with people who felt they could not afford the arc light; and they could put in ten of them where they put in one arc light in the dull season. They could run them any distance, and they were perfectly safe.

Their insurance inspector was satisfied with them. With the guarantee of the inspector and the experience they had, they were going to increase their commercial business much more than with the arc system. As for small incandescent lights, they were just beginning to use them, but had not gone far enough to give any information about them yet, as to whether they would be profitable or not.

Mr. Bowen noticed that in Chicago they were putting several incandescent lamps in store windows, leaving the arc light for the back of the store. He had no doubt that the 125 c. p. lights would become quite popular.

Mr. Slattery being asked to make some statement with regard to his "sun" distributing system, said: I am engaged in manufacturing these goods, not using them. I and those with me in the same line feel that we ought to come here and listen to the verdict rendered by those who buy our goods, and also to hear the criticisms that are extremely useful and necessary to us in making goods to meet the requirements of varying markets. It has been most encouraging, indeed, to hear the satisfactory expressions on the part of some of our friends with regard to the proper application of incandescent lights used upon high tension currents. There is a great deal of mind at the present time concentrated upon problems involved in this matter, and the suggestions that have been thrown out and the criticisms advanced are, as I have said, extremely useful to us, and I would very much rather remain a listener than be a speaker. I am more of a worker.

The use of the incandescent lamp on high tension circuits has been a great difficulty for the manufacturers. Difficulties apparently innumerable and insuperable have presented themseves continually in working along that line in the past, and have been discouraging; but I have never known anything that has been called for by the public that has not been produced by some ingenious individual; and so I look forward with a great deal of hope to the immediate future, when will have to be met the rapidly growing demand for incandescent lamps for high tension distribution. As to operation, no doubt great troubles have been met with from grounds upon arc lines; but those grounds, too, have chiefly occurred through careless installation, I believe. But now, with greater efficiency and competency in the line of installation, it seems to me that at the present time we can overcome all the difficulties that have heretofore rendered efforts in the direction of high-tension distribution very disheartening. Our company—and I speak with considerable reserve, as it might look like an advertising statement—has been endeavoring to meet this new demand. We make a box that enables people who are using arc lights to distribute as flexibly as if they were dealing with low tension. Being manufacturers of a complete system, with the exception of the dynamo, we have been able to make up any form that has been called for by customers, and I came here to-day to hear the verdict passed. It has been gratifying to me that in many cases great satisfaction has been expressed; in some cases, friendly criticism has brought out weaknesses that there will be no difficulty in overcoming. As the weeks go by—not the years now—I think that the subject of high tension distribution will receive greater and greater attention, because we are working so closely to the varying demands made upon us by the public at large.

Mr. Rhodes said that a great many of them would like to know a little more about Mr. Slattery's distributing box.

Mr. Slattery invited the members to his exhibit, and gave some details, such as will be found later in the notes of exhibit.

Mr. Law laid stress on the necessity of using safety fuses on both sides of the circuit, and had a strong opinion in favor of running the incandescent wires close together for safety reasons, rather than so widely apart.

Mr. Duncan had been running incandescent lights since March, and thought the drift of the whole discussion was to show that the combination of arc and incandescent lighting, as separate systems in the same station or by means of the distribution box, was the necessity of the time for electric light men, and the ones working in the latter field were those whom they should look to for long-distance incandescent lighting. He spoke also of his satisfactory experience with large incandescents—burning 2,300 hours without appreciable reduction of candle-power. In large cities, he said, no disposition existed to displace arc lights, except as inside lights. The demand for incandescents came from stores and such places, where, instead of being bound up to an arbitrary rule for light on and off, they wanted a light to turn on or off, to suit their convenience at any time. He found them ready to pay for that kind of light if they could get it. For 2,000 feet away from the station, you could supply that light with a better profit direct from the machine. They charged $1 per month for an ordinary 16 c. p. light. He found that the average burning was not more than 4 hours a day.

With regard to the report on wire gauge, R. W. Pope said he wished to amend the statement that the manufacturers were not yet recognizing the new standard in their work. He called attention to an exception which had just been brought to his notice, by reading the following card:

DEAR SIR: In compliance with the resolutions passed by the National Telephone Exchange Association and the National Electric Light Association, I beg to inform you that hereafter all catalogues and price-lists issued by me will be made up and based upon the "standard" wire gauge.

Our wires and cables are on exhibition in parlor C.

Yours truly,

CLARK B. HOTCHKISS, General Agent.

Mr. C. C. Haskins then read a paper on

WIRE JOINTS

Joints, splices, connections, by whatever name we may designate them, play an important part in all vehicles of electricity. From that conductor which carries the pigmy talking current of the telephone or that other feeble weakling which from the manager's desk rings up the nodding office boy, on the one hand, to the carrier of a giant power which lights a thoroughfare, or, successfully combating the forces of nature, attracts the metal and repels the dross in a valuable ore on the other.

The influence which one of these junctions may exert for good or evil is varied by an element in the question liable to be overlooked by a casual observer. A connection which will answer all necessary demands in a burglar alarm wire or a call-bell circuit, the simplest of all connections, a bell-hanger's joint, might be an element of untold annoyance and loss if placed in the path of another form of current. In telephone work, too, an imperfect joint, provided it is not loose enough to set up a microphonic action, is usually considered a matter of comparatively small importance, provided the subscriber pays his bills promptly.

In both these cases the original outlay for mechanical power is so slight, the weight of copper so small, the entire combination so simple, that a renewal of the plant would be hardly more than the re-insulation of an ordinary central electric light plant, and hence of little consequence.

The average electric-light man is a graduate of some one of the schools alluded to above. He comes, usually, from either the telephone or the telegraph department of electricity, and naturally brings with him the ways and ideas which pertain and belong to those enterprises. The unlearning, the forgetting of certain of these ways and ideas, the reteaching of such employés is really a matter of more labor and less progress than if the scholar were one who had never been a toiler in any electrical field.

The telephone man will tell how many hundreds of joints he has made without even scraping the wire, and that all the connections on the switch-board where he learned the business were fastened without soldering, and no "lines ever worked better than they did in the old N. G. Exchange."

And the telegraph man boasts of the thousands of joints he has made where he twisted a No. 9 wire so tight that years afterward, when Doran, or Bristol, or Pat Whalen renewed the line, in each of his joints that was opened they found the line of contact between the two wires as bright as the day it was put there, perhaps, before the war. It is hard teaching old dogs new tricks.

The telegraph people have an advantage over the electric light people in this: Their lines are all run in a way to enable an electrician seated at some telegraph centre like Chicago, New York, New Orleans, or San Francisco, to connect with any one of these which is working unsatisfactorily, study its symptoms and prescribe for the disease, no matter how far away. An expert at the terminal of the cable connecting two continents will measure the distance to a fault in the line and locate it so nearly that it is picked up with little difficulty.

In a telegraph line an amount of resistance equivalent to that of one relay in the line would be readily compensated for by a slight increase of battery power, or still more easily by the adjustment of the instruments in the line. Such an addition to the resistance of an electric light circuit might be almost equivalent to shutting down the plant. On the other hand, a current which the telegraph service requires would be effectually stopped by a resistance to which a dynamo current would pay little heed.

Experience shows that a bad joint is more readily found by using a small battery than a larger one. Such a joint on a line having, for example, 25 cells of battery will occasionally open the line and thus cause annoyance, while for the most part of the time the line will remain closed. Now if while it is open the twenty-five cell battery be short circuited with a thirty-ohm relay in circuit, when the battery is again opened out suddenly the line will close through the imperfect joint.

Several explanations of this peculiar phenomenon have been suggested. It has been claimed that a mechanical closing of the fault is produced by the metallic expansion due to heat. Another suggestion was that the two electrical conditions either side the brake, being opposite in character and mutually attracted toward each other, that these acted magnetically and closed the gap by attraction.

In all this matter of insulation and conductivity we must bear in mind that these terms are only relative; and that while a moderately low insulator answers every purpose for a battery current, the magneto current will overstep the obstruction; and when we have increased the insulation till this will no longer permit the passage of this force of higher potential, we have only to discharge the spark from a Holtz or other frictional machine to see that what was but just now an insulator has become a conductor. This spark will go readily through a silk hat or the sole of a dry boot. Taking an extreme, what are we to think of the insulation resistance of a layer of dry air, a mile or more in thickness, through which a thunder bolt descends from clouds to earth?

It may be claimed that the water-drops in a storm serve as stepping-stones for the current in this case, but it must not be forgotten that the same condition of affairs does not exist in a snow-storm, nor in many instances where heavy discharges of lightning occur just previous to a summer shower.

One thing more in this line of digression. A joint having more than the normal resistance of the line, like any portion of the wire which is too small, will always show heat in proportion to such obstruction.

The only instrument known to the average electric light man, for any form of testing, is the magneto bell, the introduction of which into this service for such purposes I look upon as a most lamentable mistake, in that it is incompetent for good, while it is abundantly powerful for mischief by misleading those who rely upon it. But for the existence of this imbecile machine, I feel certain that long ere this the inventive genius of electrical scientists would have given to all a cheap, comprehensive combination, capable of making all necessary tests for any form of electrical plant. As it is, its application to a line can only give one of two answers: the bell rings or it does not. If it rings and the circuit through which the current flows is short, why, it rings! If the circuit is a long one, it may ring when there is an actual insulation of thousands of megohms, and possibly ring louder than if there was a leak. I know of no practical way by which the amount of leak can be ascertained by the use of a magneto bell.

The old saw about the danger of a small amount of learning is sometimes applicable to the employé in charge of an electric light plant, however good his intentions are, however ready he may be to learn. There are certain acts which he performs which naturally lead up to certain results he does not always know, and often does not care why. Like the fireman in the gas-works who said, "I don't know nothing about your hydrogin nor your oxogin nor your nitrogin, but I know when I puts coal under the retorts the holder goes up." Feeling too, as he does, that all the knowledge he has acquired has been through his own unaided efforts and ability, he quite naturally bottles up his experience and allows his successor to accumulate a fund of information for personal use in his own way.

Since my attention was first drawn to electric light circuits, I have had no end of controversies with these, my co-laborers, many of whose names I have seen catalogued in popular lists as electricians, men who talk familiarly of "computators" and "low currents," "induction" and the old-fogy idea of using "sodder" in joints. These disputations have not always resulted in conviction, but when I have succeeded, by stubbornness, in convincing my learned peers, something like a "before and after taking" picture has usually proved the best argument.

During the first six months of my experience as inspector, I visited a plant and made the acquaintance of the electrician in charge, who informed me, with a deal of satisfaction, that he "knew all about electricity." This knowledge he had acquired in a year and a half, while in charge of a plant of twenty-six lights. It goes without saying that he had invented a complete system of electric lighting which was soon to astonish the world. His ability was demonstrated by the condition of his circuit. In this there were ten or a dozen wire joints, none of which had ever been soldered, and all were more or less loose. One near the dynamo was so imperfect that the two loops of which it was made rattled like the links of a chain. The circuit had three sizes of wire, and in several places was fastened to the wood-work with wire staples.

The changes which I deemed necessary were the cause of much discomfort to the proprietor of the plant, who had great faith in his "electrician," and the inspection fee was grudgingly paid. In less than a week I heard from the owner of the plant, who said that the saving in coal would pay all the expenses in two or three months, and that they "were getting a much better light now with a much slower running dynamo." A still more striking illustration of the necessity of good joints is part of my experience. In this case a central plant having been in operation some two or three years had gradually deteriorated until less than half the guaranteed number of lights could be burned on the circuit, and these were not up to the normal light standard.

It was one of those plants which is constantly undergoing changes; lamps, discontinued at one point, were cut in at another, to suit the whims or necessities of consumers, until the entire three miles of wire was but little better than a scrap heap line. From that three miles of wire over one hundred connections, good, bad and indifferent were overhauled, inspected and renewed where necessary. How the dynamo had been able to maintain as many lights as it did, was a mystery. The entire circuit, cold, measured over three hundred ohms. The line after the necessary changes were made, came back to its normal condition, and is to-day performing its proper functions.

There are two requisites in a wire splice which, I hold, are too frequently ignored. A badly shaped joint is exceedingly difficult to properly insulate, and an uninsulated joint in some cases may be an element of extreme discomfort both to patience and pocket when the inevitable electrolysis gets a foothold through the intervention of moisture, and oxidation sets up abnormal resistance. A joint, then, should be not only perfect as a connection, but perfect as to insulation.

The greater portion of the joints in the case mentioned a moment ago were of that class of abominations known to all of us connectors: A brass sleeve to receive the wires and a couple of iron screws to hold these in place.

In this combination we have the metallic elements necessary for a local battery, small, it is true, but abundantly capable for mischief, and with every heavy dew, with every fall of rain, we have the necessary fluid to set our battery in action. This form of joint is usually left uncovered to render it handy for testing or cutting in loops.

Electrolytic action introduces an oxide, which coats the inside of the loose fitting sleeve, until the total carrying capacity of the joint is the contact between the iron screws and the wire, with an occasional touching in the sleeve, providing the screws are driven home with a force capable of twisting off their heads. Otherwise, where these have worked loose, an arc has sometimes been established, melting off the conductor, and waking up a fire department.

Now let us look at the condition of affairs on such a circuit. Suppose the capacity of the plant is 20 lights. To insure good work a wire equivalent to a number six American gauge is necessary. Reduction in the carrying capacity of a joint is equivalent to the introduction of a smaller wire in the circuit, which means reduction in the current, reduced illuminating power, more coal and an average increased amount of profanity from lamp-trimmer to proprietor, and dissatisfaction on the part of the consumer. For the flow of current is the quotient of the electromotive force of the generator, divided by the resistance of the circuit, and the greater the divisor the smaller will be the quotient. One bad joint in a line may offer more obstruction to the passage of a current than all the lamps on the circuit put together. Such an amount of resistance

on a telegraph or a telephone line, however, would be a matter of very minor importance.

It is sometimes easier to diagnose a case than to prescribe for its cure. I have stated that I considered it essential that there should be abundant carrying capacity in a joint, and that this should be protected by an insulating covering. The first consideration is satisfied by any form of joint which is soldered; but by the presence of a second metal, a brass or iron connector for a copper wire, or a copper or brass connector for an iron wire—these become battery elements in combination, and dampness from whatever cause is ever ready to complete and set the battery to working.

The American telegraph twist joint closely and firmly made; the Britannia joint, in which the two wires, turned at the ends to prevent slipping, are bound together with a third smaller wire; the scarfed joint; the parallel copper tubes which receive the wire ends and are then twisted; and the copper sleeve which is provided with openings through which to solder the wire; all these are good when soldered, to fulfill the first requirement of a complete joint; and the one of all these which permits of the most thorough insulation by wrapping, combined with sufficient strength, is the most perfect joint.

On the other hand, the most perplexing joint, and one which has given our electric-light people the greatest annoyance, is that which serves as the junction of the overhead and underground wires, where the latter are covered with lead and the former is of the underwriter or painted wire variety. The ease with which one of these joints will absorb moisture and bridge over from the underwriter wire to the grounded metal covering of the underground wire, and so drop the insulation resistance below a safe point, or, aided by a second ground elsewhere, set up an arc and a row among the fire worshipers at the same time, is both provoking and astonishing.

There seems to be a deal of satisfaction in a quiet way to a bit of spun fabric, when it can find a trifle of moisture somewhere and carry this to where it is not wanted by capillary attraction, and thus set at naught all but the most carefully prepared underground joint work. The simplest and most thorough remedy for this trouble is to carry the underground wire far enough above the soil to escape the moisture, before joining up the other wire. The objection to this is the cost of the additional cable or underground wire.

My best success in defeating the wiles of the enemy in such cases has been achieved through the use of asphaltum. I claim nothing new for my method, unless it be in the quantity used. I first bare the wire several inches either side of the joint, after the splice is complete and clean of all moisture, acid, etc. I then paint the naked wire with hot asphaltum up to and beyond the insulation on the white wire and beyond where I intend wrapping over the lead. After two or three coats, I alternately wrap and paint, thoroughly insulating each wrap from the next, until the whole is well covered. In no case would I permit the wrapping to touch the lead or the white wire beyond the painted portion.

If this is done faithfully there will be no connection between the lead on one side and the white wire on the other, by which moisture will travel across, and if the joint is finally left in such a position that moisture accumulating on the lead by condensation will have to run up hill to reach the joint, and the line is kept clear of ground leaks, there will be, I fancy, little annoyance at that part of the line.

There is a traditional belief, as widespread as it is erroneous, that tape well rubbed down will stick forever. What a pity this were not the fact. The oily constituents of the insulation soon evaporate, and the tape peels off. A couple of inches of small wire will hold the last end of a piece of taping, if carried once around, and the ends are twisted together.

There is sometimes a fruitful source of trouble through imperfect contact at the lamp binding-posts. An imperfect contact, a loose screw, may result in an arc and serious injury to the lamp at that point. The constant vibration of the wire there tends to loosen the binding screw and, of course, to encourage trouble. Any form of hanger which shortens the loop of wire leading out to the lamp reduces the amount of this vibration and lessens the possibility of trouble at the binding-post. This loop may be successfully done away with on either permanent lamps or those which of necessity must be lowered or raised, and experience has shown in Chicago that hangers which accomplish these results are far better and safer than the old form, not only on account of lessening the danger of a bad connection at the binding-post, but on account of other good results which do not properly belong to the branch of electric lighting now under discussion.

Probably the very worst joints on a plant, all things considered, are those sometimes found in the dynamo room. Here under the eye and within reach of every employé of the company, the wires bear a certain resemblance to a lot of last year's spider webs, or the abandoned drying room of a country laundry. Call the attention of the party in charge to this condition of the wires and connections, and he invariably tells you that these are only temporary, though the dust of months has accumulated upon the joints; the wrappings, where there are any, are flying in the air like piratical signals of distress, or hanging like a rag on a sore toe, and the wires are covered with black particles that tell of age and neglect. When I see one of these temporary wired dynamo rooms I dread to attack the circuit, for I feel quite sure I have an uphill task before me. It is usually an index to the condition of affairs all along the line. Such a dynamo room is in excellent keeping with a line filled with bad joints, ragged insulation, poorly attended lamps, dissatisfied consumers and unhappy stockholders. On the other hand, when I find the dynamo, wires and connections in proper form in the dynamo room, I feel that I shall at least be seconded in my efforts at reform, and usually am not mistaken.

Facts are usually capable of being borne out by figures. While the wires used in electric-light work are perhaps less liable to become affected by imperfect connections, a comparatively lower resistance may result in serious trouble. In telegraph lines where iron wires are used, experience has shown that there may occasionally be found a joint of extremely high resistance, and, incidentally, I may mention that in the electrical department of the City of Chicago there are several of these specimens preserved.

The measurement of some of these are 2,000, 2,800, 4,000, 5,000, and one measures 20,000 ohms. Each of these joints was taken from a working wire.

In conclusion, while primarily an electric light plant is dependent on its power and its insulation for economical results, no inferior factor in the question of success lies in the connections, whether these are permanent splices in the line wire, binding posts, screws at the lamps, or spring jack contacts at the switch-board. In each of these, and all other contacts which may occur, we must not forget that the law of Ohm is applicable.

The members preferring to ruminate awhile on this, no discussion arose. Adjourned till 3:30.

The next paper read was by Mr. A. S. Hickley on

CARBONS FOR INCANDESCENT LIGHTING.

It is not my object in this paper to enter into a lengthy description of carbons of various makes or to criticise what others are doing in that branch of electrical industry, but to offer a few remarks especially connected with the manufacture and testing of carbons, as far as I have been connected with the production of the same.

Incandescent lamps can be, and are, produced which to a greater or less degree fill the requirements of the light-loving community (that is, as far as small lights are concerned) so as to induce many to invest large sums of money in electrical incandescent plants.

Many invested largely at first on account of their novelty, others as an advertisement; but as the novelty wore off, the consumer became interested as to the actual cost of running. In many cases they found their supply of lamps failed long before they expected, and they had to buy more, or allow dynamos, fixtures, and in many cases engine also, to lie idle. Then the question arose: Which are the best lamps to use, and what constitutes a good lamp?

A long-lived lamp is not always an efficient one; you may have a lamp which lives 1,000 hours, but costs you too much to run. Better have one which lives only half that time, but which remains clear, or comparatively so, to the end, and requires one-third the power to run it. Of course, the consumers want both qualities, longevity and efficiency.

With a view of meeting these requirements, I commenced a series of experiments with carbon of every conceivable description of material and compound I could obtain; and although I recognized the fact that others, far more competent than myself, and with unlimited means, were working with the same object in view, I yet hoped a few crumbs might be left or overlooked which would fall to my share, and help towards the production of something better than was then upon the market.

It is not necessary to refer back to the many disappointments and failures of first experiences, for we have all been through that more or less. Suffice it to say, it soon became apparent that, as a general rule, an efficient carbon was not a long-lived one, and *vice versa*.

The question then arose, Why is that so? and after many experiments, both in baking, preparing and treating, exhausting with and without gases within the globe, I gathered some facts which I have the honor of bringing before you to-day.

I soon discovered what is now a recognized fact, that after reaching a certain point of incandescence the candle power doubled up with the increase of a very few volts. A 16 c. p. carbon at a 100 volts, made of a certain material, became 32 c. p. upon the potential at its terminals being increased to 120 volts; again, the E. M. F. falling to 95 volts reduced the candle power to 10. The size of the carbon had little to do with this in many cases. Thus a carbon of a certain size and 6 inches long, took 8 ampères with an E. M. F. of 100 volts to produce a 16 c. p. light; another of the same diameter and length took 4 ampères and 100 volts to produce the same light. But let us watch them burn; at the end of 100 hours the 8 amp. lamp was becoming dark upon the inside, the 4 amp. one remaining as clear as when new; at 500 hours the 8 amp. lamp was so black that the carbon could be seen only when burning, and gave a light externally of but 6 candles. The 4 amp. lamp still remained clear, but burnt out at 550 hours, and had given not less than 15 c. p. until the end. Upon breaking the 8 amp. lamp the carbon was found to be roughened all over, the roughness being evidently caused by small particles of carbon being thrown off, these particles not only causing the carbon to increase in resistance by their separation from the main carbon, but carbonizing the interior of the globe as mentioned before.

Carbons of the same material but of different diameter were then tested, all, I may say, being carefully examined before and after the tests through a powerful microscope. Two carbons were tested, each one being 100 volts, but one being twice as thick as the other. The thicker one gave a 16 c. p. light with the consumption of energy equal to 70 watts. The thinner one gave 40 c. p. with the same power, but the latter soon burnt out, and upon microscopic examination it was found that the fibres were cracked all over and were bent at right angles to the grain of the material and sticking out, as it were, towards the glass. I tried this upon a large scale and made a carbon as large as a No. 13 wire. It behaved precisely the same, but now the fibres were quite visible to the naked eye and stood out all over the filament as though it had become indignant at being abused and roughened, its coat resembling an electrified cat or a porcupine. With this carbon I could produce a light equal to a candle for every watt, with lamps of fifty candle-power, but it would show fight and throw off its jacket. This was overcome at last in a manner I will explain later.

A carbon composed principally of the mushrooms formed between some arc-lamp carbons, forced through a small hole under great pressure, threw off particles as soon as they were rendered sufficiently incandescent to be efficient. Structureless filaments behaved the same way, especially when not treated in a hydro-carbon.

Much depends upon the manner in which carbons are treated; a rapidly deposited carbon is very hard and more efficient than one deposited at a lower temperature, which is soft and mealy; but the hard deposit is in lumps, which appear under the microscope to be united only to the main carbon at their bases; a hard, almost flint-hard, carbon (for there is such) is longer lived than a soft one, but the latter is oftentimes the more efficient. I refer here to untreated ones.

The fact then appeared to me that the soft carbon (porcupine description) with a jacket forced upon it which it cannot throw off or ruffle, would be *the* carbon.

So, having decided the first or base, the question then arose, With what sort of jacket should it be covered? I was not entirely satisfied with the treating or improving in hydrocarbon alone, and having exhausted, as far as I knew, the vegetable fibres, I tried animal of all kinds except the Chinaman's hair, which, I learn, some one has actually patented; and I found that, size for size, the animal carbons were behind the vegetable in efficiency, but they could be used much smaller, considering that they were not so disposed to disintegrate.

Experiments then showed that a carbon, which was exceedingly efficient but too soft, coated with a fine animal carbon, wonderfully lengthened its life and allowed of its being brought to a very high incandescence without destroying it.

The vegetable may be softened by an alkali and wrapped with an animal filament, and, after carbonizing, both are found to be united almost as one. In fact, the vegetable has a coat upon its back which fits so tightly that it is compelled to keep its own on.

Again, in large carbons for 10 ampères a large amount of heat is produced, and if that heat could in some way be used before it left the carbon it would be beneficial.

It will be found that a large carbon built up of a number of small ones intermixed with glass in a very finely spun state and then wrapped, as described above, with any good animal carbon (of course this is done before carbonizing) will be very efficient, the carbon communicating sufficient heat to the finely divided particles of glass throughout its structure and rendering them conductors for the time being. A carbon of this construction appears to remain hot for a considerable time after the current is cut off.

Coating the vegetable fibre with another material, whether animal or vegetable, greatly increases the surface. If this carbon is heated to a high state of incandescence innumerable miniature semi-arcs appear to be formed all over its surface, wonderfully increasing its light-giving power.

Another important point to be considered is the preparation of the material before carbonizing. Many substances require little or none, but the greater portion must pass through a certain change first; some have a gelatinous or sappy substance contained therein, which if not removed or changed will cause miniature explosions within the material itself and the fibres will be ruptured.

This must be most carefully avoided. A carbon which under the microscope appears to be a bundle of loose threads is of little value for incandescent lamps. You may treat or improve it if you like, and so cement the fibres together that to all appearances you have a good, hard carbon; but its back-bone is weak and an overcoat upon that, buttoned ever so tightly, provided it is made up of semi-detached particles (only cemented together at their bases and extremities, which is the case with a deposited carbon deposited in the usual way), will never make it long-lived. But it will be constantly increasing in resistance from the time it is put upon the circuit. If you have a fibre which, when baked, cakes or cements itself in a solid homogeneous mass, exhibiting no loose, hair-like projections, then you need not trouble about subjecting that material to any process before carbonizing. On the other hand, as I have tried to show, a good material which cakes or cements itself to itself and to any substance upon which it is wound or braided, will sometimes save the weaker fibrous material upon which it is so wound.

In baking, also, it is of the utmost importance that that process be not carried too far, for you want the life of the carbon in the lamp not burnt out in the furnace. But at the same time you must bake enough. It is possible to bake so little that the filament when removed from the molds, although to all appearance perfect, is virtually no conductor at all. Carry this a little farther and it becomes a poor conductor, but is not sufficiently changed to be of any use, for as soon as the current is forced through it, it bursts with a snap and a ring, like steel wire. After this stage the conductivity increases to a certain point, when it again decreases, this time on account of the carbon gradually wasting away, and you are, in fact, burning the very life out of it. The point is to catch it just when it is the best conductor and before the unnecessary wasting away process commences. This can only be ascertained by repeated tests and great attention to the regularity of the heat. The heat should also be applied to the mold, crucible or whatever form of receptacle you use to contain your fibres, as evenly as possible. The whole should be brought to a glow throughout and at all parts at one time.

I have carbons which were baked so that their extremities, that is, where they are connected to the platinum, were overbaked and ruined, while the bow or upper part was scarcely done. Examining this carefully through a microscope, the ends were found to be weak and frayed out and useless, while the upper part, or bow, was solid, glossy, and appeared to consist of an entirely different material.

Again, some substances may be baked in bundles bound together, each one keeping its neighbor in place, while others would cement together in such a manner as to render them useless. Do not bake too many in the same receptacle at one time, or so much gas will be given out that partial combustion will ensue unless you have some means of pumping out the occluded gas as fast as produced. Some substance, such as camphor, placed within the retort will sometimes enable you to bake successfully a material which otherwise would be useless.

I have burning at the Russel House lamps which contain a vegetable carbon surrounded by an animal carbon. The vegetable alone in this case would be useless, but the animal covering preserves it and renders a high state of incandescence possible without disintegration.

In fact it can, without injury, be maintained at so high a state of incandescence as to produce a bluish tint which enables you to readily distinguish colors.

The efficiency of the carbon in this lamp is a little over one watt per candle power.

I am manufacturing these lamps for the Jenney Electric Company, of Indianapolis, and find them very efficient.

Mr. Slattery expressed briefly his dissidence from Mr. Hickley on some points, and avowed some incredulity with regard to the "one watt lamp"—Mr. Hickley claiming a consumption of only 425 watts for 400 c. p.

Mr. Hickley remarked that his materials and line of research were different from Mr. Slattery's; hence perhaps the variant results arrived at.

The following paper was then read by Mr. Arthur Steuart, of Baltimore:

THE LEGAL RELATIONS OF ELECTRIC LIGHT COMPANIES TO TELEGRAPH AND TELEPHONE COMPANIES AND THE PATENT OFFICE.

As Chairman of the Legal Committee permit me to present the following report upon:

First—The legal relations of an electric light company to a telegraph or telephone company in relation to the interference with telephone or telegraph business by electric light currents, and

Secondly—The relations of electric lighting to the patent system.

1. How far has a telephone company a legal remedy against an electric light company for interference with business due to a necessary incident of electric lighting, such, for instance, as induction?

In approaching this question we are met by one fact which exists in almost all cities of this country, and that is the fact, that the telephone companies are in almost every case in full possession of the field, and when an electric light company comes in and causes any disturbance of business, it is interfering with vested and established rights. But leaving this situation out of the question, because it is not a controlling one, we must fall back upon the principle that no man can use his own property (within reasonable limit) so as to injure that of another. I say within reasonable limit, because this doctrine can be carried too far. The demands of modern civilization are such that even if it were impossible to conduct a telephone and electric light business in the same district without very serious injury and obstruction to telephone lines, it can almost be said with certainty that the public would put up with very bad telephones rather than be deprived of electric lights. But, fortunately, this is not the case. Electric light wires and those of telephone and telegraph companies can be used in the same district, and if properly arranged will interfere to a very small extent with one another, but this harmonious operation of the two systems is only possible when some care is taken to prevent the difficulties, such for instance as hanging the wires far enough apart not to influence one another injuriously. If, however, an electric light company were to persist in placing its conductors so close to telephone wires as to cause injury to the telephone business, there would certainly be a remedy by way of injunction and damages at the command of the telephone company. Just here let me say one word on the subject of the oft attacked underground systems. A law which requires all wires to be placed underground would entail the adoption of some system in which wires of the different classes placed in the same sub-way could be so separated that they would not produce any inductive effect upon one another.

2. The second point upon which your committee is called upon to report, is that of the relation of the electric lighting to the patent system. Some of you who may have some granger interest, will doubtless be surprised to hear me say, that to the patent systems of this and other countries alone, you and the people of the world owe almost everything in the shape of improvement in electric lighting which you now possess.

Such men as Wendell Phillips have said most truly, that to our patent system we owe our superiority over the periods and nations of the past. Many were the arts and processes, known to the ancients, of which we see the fruits, but the methods were lost, and why? Because there was no system existing at the time that the inventors lived, which offered to them any inducement to disclose their secrets; they kept them, therefore, locked in their own breasts or communicated them only to a few chosen compatriots, all of whom were bound by a solemn oath, on penalty of their lives, not to disclose them. Some vicissitude of life swept all those possessed of the secret away at once, and they were lost. Under our system such a thing is impossible.

It is not my purpose to go further into a eulogy of the patent system of this country, for I know that most of you have had such practical and profitable experience of it as to need no argument from me to enlist you in an effort at its support and protection.

There is, as you are all very well aware, a large class of voters in this country who, from some cause, are violently opposed to the whole patent system as an element in our national life and policy, and, unfortunately, this class is so large and politically powerful that the halls of Congress are ringing with attacks upon the system, and the courts of the country are seriously affected by the outcry, so much so as to have become technical and much less liberal than formerly in their construction of patents. And we, gentlemen, who from the standpoint of our daily life see the great, the immeasurable advantages that have been, and are being, derived from the operation of the system, are called upon to make our voices heard in its defense, to appeal to Congress to support the growing industries of the country by protecting their developments, and to the courts to be liberal in securing to meritorious inventors the full benefit of their contribution to the knowledge of the world.

There are several special points to which I will direct your attention, and if the gentlemen think well of the idea, we would suggest that the weight of this Convention be thrown into the scale to carry them into effect.

Improvements Suggested in the U. S. Patent Office.

1. The burden of work that is imposed upon the examiners in the Patent Office has so rapidly increased of late years that the force now employed is entirely inadequate to accomplish what is assigned to them.

For years past the Commissioner of Patents has been petitioning Congress to authorize him to expend some of the large accumulated surplus, about $350,000, which is lying in the U. S. Treasury to the credit of the Patent Office, in the employment of a force adequate to perform the work daily pressing upon him. But so far, his petitions have been unheeded. The department that suffers most by this lack of force is the electrical, because that one is most heavily burdened just at this time.

2. Another subject of special interest to electricians is a suggestion made by the Commissioner of Patents in his last message to Congress, and that is a request that money be appropriated to erect an electrical laboratory for the use of the examiners in the electrical department and for appliances. This is a very important matter to all persons applying for electrical patents, as it will afford facilities far greater than ever existed before, for the examination and demonstration of electrical inventions, many of which require that the examiners shall be carefully instructed by the applicant, in order that a proper patent may be procured.

3. Some plan should be devised by which a higher class of men would be employed as examiners in the Patent Office. At present the men are fairly good, but with the exception of the principal examiners, few of them stay more than a very short time in the office. In fact it has become a custom that young men will go into the department, and after staying there for one or two years, will resign and establish themselves either in Washington or elsewhere as patent solicitors.

It is very desirable that the examiners in the Patent Office should be the very best and most experienced men that can be procured for the purpose, and when once secured they should remain in the position for a number of years.

To accomplish these results the suggestions that occur to us as most likely to secure them, are to increase the pay and provide for the pension of examiners after a certain number of years of faithful service. In addition to the foregoing, it would be well that a system of annual or biennial examinations such as exist in the navy be instituted, because it is very important to the interest of applicants that examiners should not only be thoroughly educated and intelligent men, but that they should keep fully up to date in all matters with which they have to deal, both in science and law.

Improvements in the Patent System, Relative to the Trial of Patent Causes, and the Reduction of the Cost of Litigation to the Owners of Patents.

1. In the trial of patent causes, great difficulty and loss of time is experienced, as well as great expense imposed upon the litigants by the necessity for the employment of experts, whose duty it is to elucidate the subjects in question for the benefit of the court, and to set forth the facts, as well as their opinions before it, in such shape that it will be able to fully comprehend them, and to apply to them the law for the purposes of decision.

It is the custom in this country for each party, plaintiff and defendant, to employ their own expert, who examines the case from their standpoint, and gives his opinion accordingly.

The reputation and ability of these gentlemen determine the cost to the litigant of their services, and it usually happens that their bills run into many hundreds and often thousands of dollars. For the purpose of overcoming this difficulty, it has long been the custom in the English courts for judges to call upon experts to assist them in the trial of patent cases. These experts are employed by the Crown, and are not permitted to take employment from either litigant.

The benefit of this system is apparent. Instead of being compelled to encumber the record with a large mass of expert testimony, as well as charge the litigant with the high cost of the same, he will be enabled, by simply proving his facts, to go to a Court of Equity and argue his case before unprejudiced and sworn experts, trained in the art to which his patent appertains, who will instruct the Court as to the facts, and leave it free to determine the law unencumbered by a mass of technical matter often little understood by the judges.

One of the uses to which these experts could be advantageously put, would be to make them judges in interference cases, and other matters relative to applications for patents in the districts in which they were located, so as to afford additional facilities at reduced cost.

You have all, doubtless, had some experience in procuring legislation in Congress, and have found that the best and most important measures will languish and be neglected unless some one makes it his business to keep the ball rolling, and unless all those interested in a measure will unite to have it taken up and favorably considered.

Some of these suggestions have been repeatedly before Congress in the reports of the Commissioner of Patents, but as a prominent Washingtonian said to me some time ago, when I asked him why they had not been passed:

"What is everybody's business is nobody's business; they have, therefore, been overlooked because they were not brought prominently forward by some one who was personally interested."

We would, therefore, request that if this Convention think well of the suggestion of this committee, they authorize the committee to prepare such bills for Congress as will carry them into effect, and then when copies are furnished to the members they will individually use all their personal influence with their Senators and Representatives to have the bills passed and made laws.

In this way great good can be done by this Convention which will be of lasting benefit to all members as well as to all the inventors of the country.

Legal Bureau.

We have been requested by the Committee on Bureau of Statistics to submit a supplemental report to theirs upon one of the heads upon which they have touched, that is to say, upon the "Legal Department of the Bureau," because they consider that it would very properly fall under the subject of the "Legal Relations of Electric Lighting to the Patent System," which was assigned to your committee for consideration?

1st. What should the Legal Department be, and what is the need for its creation?

The Legal Department, as suggested by the Committee on Bureau of Statistics, would be a branch of the Bureau of Information, to be in charge of a competent person skilled in electrical and patent matters, and to be always at the command of the members of the Association, for information relative to patents upon machines or devices connected with electric lighting.

The need for the creation of such a bureau is very great, and is felt by many of you, and I am sure, when carefully considered, will be fully appreciated by all.

The whole field of electric lighting apparatus, from the dynamo to the lamp globe, is covered on every square inch with patents of greater or less strength and breadth.

You will be surprised when I tell you that there are at this time in force in this country, on generators and lamps (arc and incandescent) alone, something more than 1,750 patents, not to mention those on collateral details in addition, not included under these heads, and they are increasing with every week's issue.

It is, therefore, easy to appreciate how impossible it is for any one to enter the electric lighting business without running against some of these claims, and if no accurate information with reference to their real scope is in the possession of the person who comes upon them or is attacked by them, how is it possible for any of you to determine what is to be done when such a contingency arises? Of course it can be said: "Go to the best lawyer you can find, and get him to examine the matter and give you an opinion." Yes, that is an excellent method, provided you have got from five hundred to five thousand dollars to spend in that way. Then, too, almost all of you are licensees under one or more of these patents which are owned by individuals or corporations, that are living off of your earnings; and I suppose I would not be rash in asserting that not one out of ten of you have any idea whether the companies to whom you are paying royalties have any legal right to demand them or not. You went into the enterprise at first upon their assurance that everything was all right, and you have gone on without questioning the position of the parent companies, and will continue to do so unless some method is adopted by which you can procure at a nominal cost reliable information upon which you can act.

Your position is not a new one. Some twenty years ago the railroads of this country found themselves in very much the same position which you occupy to-day; they were creating a business, and as the amount of capital invested became greater and greater, and the dependence of that capital upon machinery of particular kinds became more apparent, these companies were made the victims of the cupidity and schemes of designing speculators, who would buy up a lot of worthless patents and then make a claim upon them for large royalties, claiming that certain appliances of vital importance to the railroad companies were covered by one or more of their patents, and the companies were presented with the alternative, either to settle or to fight; and it was a question as to which would be the more expensive. This system of blackmail became so burdensome that the companies were forced into a combination for mutual protection. They accordingly formed an association which is called the Railroad Association, the purpose of which was to employ counsel and economize the conduct of these controversies. To this association each member contributes in proportion to its strength, and from 1866 to the present time the saving to the railroad companies has been as 20 to 1, or for every dollar they have paid this association they have saved twenty by belonging to it.

The members of the association have the privilege of referring any question involving a patent to its counsel, by whom it is investigated and reported upon with promptness, and with no other cost than their annual subscription. If the counsel advises that the claimant has a just claim, he arranges with him the best terms he can for settlement, and calls upon the company to pay it. If he determines that the claim is invalid, he so reports it, and then if suit be brought the association undertakes the defense upon itself and bears all the cost.

A similar plan would supply a need to the members of this Association. It might not be desirable at this time that the Association undertake the defense of cases brought against the members and believed to be bad, but it is very desirable that a source be provided from which any of the members may be able to get an intelligent opinion upon any patent relative to electric lighting apparatus that they may desire, and that at the small cost of membership to this Association, either for the purpose of resisting demands upon them or for intelligently examining enterprises for investment.

Let any member of this Association who is a purchaser from the manufacturers of electrical apparatus, calculate the actual cost of construction of the apparatus he is buying, and compare it with the price he is paying, and determine what percentage of profit is made upon these goods; and then let him consider that this large profit and high price, in the average quite one hundred per cent., and in many cases five hundred per cent., is consequent upon the possession by the manufacturers of patents of very questionable validity, some of which are certainly void, and which, if declared so, would reduce the cost of these goods, and hence the net profits of the sub-companies in proportion. I do not think I am stating the case too strongly when I say that if these patents were examined critically, and placed upon a true and proper basis, that the average cost of apparatus could be reduced at least 20 per cent. If such were the case, and the saving thus made by all the members of this Association were added together, they would certainly amount to considerably more than a hundred thousand dollars. It requires but a comparison of this sum with the cost of maintaining this department, which would probably be some four or five thousand dollars per annum, to illustrate its economy.

2. The plan upon which such a department should be conducted would be to select a suitable person as general counsel for the association, put into his office copies of all the American and foreign patents pertaining to electric lighting, and such other books as would be desirable; or, if he were located in Washington, he could be near enough to the Patent Office to use the records there with facility.

A committee should be appointed, of which he and the custodian of the Bureau of Information should be members, with such other persons as might be selected, whose duty it would be to hear and consider the reports of the counsel upon cases examined and to determine whether his reports were correct. These reports, when acted upon by the committee, should be filed in such a manner as to be at hand whenever needed for reference.

Your committee cannot too strongly urge the establishment of such a bureau as of inestimable advantage to the members.

Mr. DeCamp thought the paper read to be a very comprehensive one, but while thinking the proposed bureau a good thing, had his doubts on the ground of association finances. The thing would be worth, however, a considerable expenditure of money, if done successfully. He suggested a committee on the subject.

Mr. Pope pointed out the difference between the association bearing such an expense and individual members bearing it. There were some members who would have little use for it. He thought some plan might be hit upon by which the needed revenue could be raised without taxing every member to carry on the proposed bureaus.

Mr. Corby offered the following:

Resolved, That a committee of three be appointed, to consist of a Vice-President and two others, who shall consider the question of the possibility of establishing the bureau of statistics at once. If after consultation they determine that it can be done, they shall decide upon a plan for its support and maintenance, and make arrangements with such persons as they think best for its conduct.

Objections were raised by Mr. Duncan, Mr. Leggett and others, that the resolution went too far in placing the appointments, at once, in the hands of the committee, thus really taking action in the matter out of the hands of the association as a whole. Mr. Leggett also hinted that the thing to be done well would be very costly.

It was finally agreed to refer the matter to the executive committee, simply for consideration, Mr. Weeks, in the chair, expressing his approval and his sense of the growing importance of the subject.

Mr. Corby then offered another resolution authorizing the preparation of bills to be presented to Congress, embodying Mr. Steuart's suggestions in regard to the Patent Office, and requiring such bills to be reported to the convention at its next meeting. Agreed.

Mr. G. W. Parker then read a paper on

THE ADAPTATION OF CARBON PENCILS TO DIFFERENT CURRENTS IN ARC LIGHTING.

The vast sums of money that have been, and are daily being, expended in buildings, machinery, dynamos, lamps and other appliances for electric lighting, are expected to return a profit on the investment. This profit, in your case, must be realized from the sale of one single product, and that is light. This product appears and is delivered to consumers at the junction of the carbon points, and however perfect may be the machinery, however well adjusted the lamps, if these points are to any great extent defective, or from any reason unsuited to the currents, the profits are curtailed and your customers dissatisfied.

For this reason the carbon becomes a most important factor in your business of electric lighting, probably the most important, for of your other appliances you have control and can regulate their defects.

The object and purpose of this paper is an attempt on the part of a manufacturer to canvass defects whether on your part or his, to discuss with you the weak points of the methods of manufacture, if any, and to gain from you, if he can, such information as will enable him to apply a remedy if it may seem necessary.

At the outset we are confronted with a fearful array of possible hindrances to a perfect light. On your side we have a want of steadiness in the motion of the engine irregular action of the regulator, if there be one; weak currents, the mechanism of the lamp not acting with sufficient power; tarnished rods; dirty working parts in the lamp, causing irregular movements; partial grounds on the line; short arcs and heavy currents forming mushrooms in some systems; low currents; leaks around the arc; overloading the circuits, either by too many lights, imperfect joints or soiled connections and probably others of which you can better inform me than I can enumerate to you.

On our part we may have impurity of material, imperfect baking, low conductivity, places of higher resistance in certain portions of the carbon, too much or too little plate, lack of coherence and density, lack of hardness for some systems and softness for others, improper selection of material for a given system and possibly others of which we do not yet know.

With this knowledge of the many mechanical difficulties that interfere with the production of a perfect light in the burning of carbons, it is necessary that both the producer and consumer should specifically, and one by one, do all that lies in their power to abate these defects. On your part it is comparatively easy, for most of them are mechanical and simply require constant and careful supervision, while the remainder can be detected by the admirable instruments devised for the purpose which are every year becoming more perfect.

It is but natural that the manufacturer should believe, admitting the many the defects that may exist in his carbons, that the imperfect light is in a large proportion owing to the lack of order in the working of your machinery and appliances.

How far this may be the case, neither side is in a position at present in a general way to know; but if in particular cases you could spare the time and would take the trouble to investigate on your side and then report to your manufacturer, with specimens and details of defective action, you would be of great service to him in thus assisting to correct a fault, which would be of final benefit to yourselves.

The difficulty that besets the manufacturer is greater than with you, from the fact that he has but a crude method of detecting differences in his goods. He can be careful as to the purity of his material, can intelligently select the different kinds of material and the different mixtures of them that are designed for the various systems, can see that his machinery is in order, that the carbons are thoroughly baked, and that they are properly plated when it is necessary. When his goods are finished they look alike, seem to be in good order, ring the proper tone in handling, and he has every reason to suppose that he will have an uniformly good account of them from his customers. And so he does, in a general way. All you want is steadiness, a good light and a fairly long life. But you will say of some of them that they flame; of others that they do not last long enough.

Now, the important question is: Whence come these differences? Do they exist in the carbons or do they arise from changes in your currents, and defects in your lamps and other machinery? I admit that this manufacture is a new business, that experience has yet to teach us something; but I have always maintained, and do now, that they can be, if they are not already, made practically uniform. There is no good reason why, that in one hundred carbons that appear to be the same, and of good workmanship, two or three or more should behave differently from the rest.

This should not be the case; on the contrary, they should be uniform; but if it is, how are me to ascertain it before we ship them to you? Can you, from your skill and experience as electrical engineers, suggest any test that can be practically applied, or devise any instrument determining conductivity, resistance, or any other feature that will unerringly tell us when our goods possess such physical or other properties, as will assure uniform behavior when they reach you?

If you can do this, and it is the essential point that I hope to accomplish by your consideration of this paper, we will gladly adopt it.

On the other hand I will take the liberty to express the opinion that, as you no doubt know better than I do, it is of the highest importance there should be on your part perfect regularity in the working of all and every one of your machines and appliances. When this is done you can then with certainty place the burden of irregularity, if there be any, upon us. I will even go so far as to say, that it would be to the interest of the owners of the different systems to employ at their own expense, experts to visit their various plants, whose sole business would be to regulate and keep in order such as did not already have skilled electricians in charge.

There is a special phase of the question that occupies an important position, and when I touch upon it, please bear in mind that this paper is not written by an expert in electrical science. It does not propose to teach you anything in that direction, but, on the contrary, its discussion is expected to further enlighten the carbon manufacturer in a practical way as to the relations existing, or that should exist, between your currents and his carbons.

I refer to the different currents of the various systems of electric lighting, and to the varying currents of the same system. The former, is, I presume, the result of a difference of opinion among electricians as to the commercial or economic value of their respective currents as applied to the apparatus they have devised for generating them. For the latter there is no reasonable excuse, and it has a prominent place among the causes of irregularity in the behavior of the carbons before noted.

In the present state of carbon manufacture it is proven beyond question, that very slight changes in the current and resistance, will require corresponding changes in the structure of the carbon. This, of course, holds good in respect to two different systems whose currents vary but little from each other, and still more where the variation is greater. I am not prepared to assert that we will never make a carbon that will burn equally well in all currents. I do not know enough at present of the causes and effects in their relation to each other, and if you can throw positive light upon them, it will assist us materially to determine the question. It seems incredible that these slight differences in manufacture, which might in some instances be termed almost infinitesimal, would affect the burning of the carbon, and thus determine the system it is intended for, but repeated tests both in actual use and in careful experiments compel us to accept it as a fact.

So far as the different systems are concerned, the manufacture cannot be varied to fit all of them separately. Experience must, as the matter now stands, determine the suitable carbon, and form these systems into certain groups that will use the carbon.

But, for the permitted variations of the same systems no provision whatever can be made by the manufacturer, and the remedy lies only with you. How many of you have meters for the purpose of determining the volts and ampères of your respective currents, and how many of you, having them, require employés to constantly maintain perfect regularity in your currents. You will under any circumstance have some irregular action in the burning of your carbons from this cause, until this is done.

In closing this brief statement of a question of very great importance, I express the hope that its introduction will have the effect to unite the consumer and manufacturer in a joint effort, to determine if it is a fact, that there is any general lack of uniformity in the behavior of burning carbons and if so, its cause, so that a remedy may be applied in whatever direction it may be found necessary.

Mr. Steuart suggested that the more experienced members get together and formulate tests for good carbon points, by which the manufacturer could know whether he was turning out standard goods that were not liable to come back on his hands on unfair pretexts and at a loss.

Mr. Law and Mr. DeCamp stated that when they got long-life carbons the efficiency of the dynamo was reduced. The lamps and machine took more power. A long-life carbon was a desideratum, but not in that way.

Mr. Pfannkuche, being called upon, gave some details in regard to his cored carbons. His description is similar to that in the notices of exhibits.

The meeting then adjourned until 10 a. m. Thursday.

The session opened on Thursday morning, at 10 a. m., Mr. Weeks in the chair.

Discussion arose as to the place and time of the next annual meeting. Philadelphia was selected, the time being left to the choice of the Executive Committee. The meeting will be held either in February or in March.

Mr. DeCamp said he had received a report from the Treasurer, Mr. C. Cooper, stating it was impossible for him to be present. He sent a short statement. Mr. Weeks urged backward members to pay their dues. Being business men, they could appreciate the importance of that.

Mr. Gilbert presented the subjoined communication from Mr. C. J. H. Woodbury on mutual insurance of electric light plants:

F. A. Gilbert, Esq.:

DEAR SIR: The results of the canvass of the electric illuminating stations, in reply to communication of July 15th, show that from 173 electric illuminating companies in the district selected for a beginning, insurance on property to the value of $1,084,179 has been offered by about 50 companies, and indefinite replies received from about $200,000 more. As some of the property included above is not desirable for mutual insurance by reason of the hazards imposed on the stations by poor construction of the surrounding buildings, or the station itself, it can be safely assumed that $1,000,000 represents the maximum amount of mutual insurance available, as far as shown by this canvass.

Now these returns do not warrant me in recommending the formation of an Electric Mutual Company, at present.

As I said at the time when the plan was first presented, the formation of an Electric Mutual Insurance Company on a sonud basis would require 150 policies of $10,000 each, and the surplus insurance desired above that amount by any station could be placed in other mutuals, or the stock insurance companies.

A company must be prepared at any time to meet a total loss on a policy, and it would certainly be unwise to attempt the organization of such a company on a basis which could not but endanger the liability of an assessment at any time. Secondly, limiting the policies at amounts which would be so far within the valuation of the property would increase the liability of extinguishing the policy at slight fires; and, therefore, other insurance conducted on a similar policy would be necessary to keep down the average impairment of policies by small fires on large risks.

These matters and the returns show that the central stations at the present time are insufficient in number, value, and in some instances character, as fire risks, to warrant the formation of the proposed organization, although it is evident to any one who has given consideration to the rapid increase of investments in electric lighting that the day is not far distant when an electric mutual insurance company will be as much of a business necessity as the textile, the rubber and paper mutual companies.

And this brings me to the second proposition advanced to you several months ago, namely, that the active co-operation of the established factory mutual insurance companies would be desirable in any event, to carry some of the insurance on larger stations, and bring the total insurance on such property up to an amount commensurate to the value of the risk, so that the policy would not be exhausted by a slight fire.

Some of these companies organized at a later date have not confined their attention to textile and paper mills, but have also written upon other industrial property when satisfactory and well protected. It was expected that these companies would take the surplus insurance on electric lighting stations beyond the amounts considered advisable to be written by the proposed electric mutual insurance company.

As the present state of affairs does not permit the consummation of the original plan, I made a statement of the facts in the case to the mutual companies named below, and they have agreed to write upon such electric lighting stations as may desire the insurance, subject to my inspection and approval of the risk.

These companies are managed in a conservative manner, and the following statements of their standing July 1st, 1886, furnished me by their secretaries, show their financial strength:

	Insurance.	Total assets.	Premiums.	Return div.
Enterprise Mutual Fire Ins. Co....	$11,544,183	$675,972.86	$113,011.48	75
Cotton & Woolen Manf. Mutual Ins. Co.....	11,181,387	643,989.23	107,421.68	75
American Mutual Fire Ins. Co....	11,086,664	657,578.01	109,868.04	75
Mercantile Mutual Ins. Co.....	4,000,144	209,690.04	35,039.22	50(1)
Rubber Manfs. Mutual Ins. Co..	3,209,671	364,401.61	43,970.76	25(2)
Total	$51,022.054	$2,551,631.75	$409,311.18	

(1). Profits for the year, 61 per cent.
(2). Profits for the year, 96 per cent.

The work of organizing an insurance company at any time requires much time and expense, which will be avoided by this course, as suggested; and if, at any future time, when the growth of electric lighting stations would warrant the formation of an Electric Mutual Insurance Company, managed solely by the electrical interests, it would be a very simple matter to cancel the policies and rewrite them in the new company.

After a careful examination of the whole matter, these companies will probably insure satisfactory electric lighting stations at a gross rate of 1 per cent., and if the return dividend is 75 per cent., it will reduce the cost of insurance to 25 cents on $100. These mutual companies do not ask for a single dollar's worth of insurance upon these stations, but in answer to the statements made to them have consented to the policy outlined above.

I have nothing to urge in the matter, but as it will be impossible for me to attend the Detroit meeting of the National Electric Light Association, I submit this statement, with the opinion that it is the best course for you to pursue under the circumstances.

Yours very truly,

C. J. H WOODBURY.

BOSTON, Mass., August 23, 1886.

Mr. Weeks said it had been whispered that Mr. Morrison was no longer to be their president. He desired to say that there was no foundation, in fact, whatever for the report. Mr. Morrison was still their president and would continue to be so. (Applause.)

Mr. De Camp, as chairman of the committee on the relations between parent and sub-companies, said that his report would be a short one. With regard to the invasion of the territory of one company by another, there had been but one case brought to their notice since the last meeting. But there was continual grumbling, and trouble was likely to break out. He thought that capital was slow to go into the electric light business for that very reason. He was glad to see in the convention for the first time the representative of a parent company. He believed it was the first time. He referred to Mr. G. W. Stockley, of the Brush Company, and was sure all would be glad to hear something from him on the subject.

Mr. Stockley: I do not know about the accuracy of the remarks as to the first appearance of a parent company, not having myself attended the meetings of the association before. It seems to me very proper that a parent company should be represented here and get well acquainted with the delegates from the lighting companies. I have been very much interested in the proceedings and the various subjects brought up. This announced to-day is one which certainly it cannot harm us to fully discuss; yet it is evident that is only one of a number of subjects to be discussed and, therefore, very much time cannot be given to it. I think that the subject discussed yesterday in the paper which Mr. Steuart read bears very directly on this subject, this morning. I can myself heartily approve of everything I heard in Mr. Steuart's paper, and I think that was the very general verdict of those present. There can be no doubt, it seems to me, that the patent system of this country is at the bottom of the prosperity of the nation; and, as Mr. Steuart intimated yesterday, this is true of other countries. If you will look abroad you will find that those countries which have made the greatest progress mechanically have been the ones in which the greatest encouragement has been given to inventors and the greatest protection. Now I was pleased to note that Mr. Steuart dwelt upon that feature of the case. It is our part as business men to make the inventions of the country as valuable to all as possible, and, therefore, to protect them. It seemed to me that the suggestions put forward by Mr. Steuart were very well made. I would endorse them all, and add just one more, which does not originate with me, but which I have heard frequently urged. It is that we should have a patent court sitting at Washington with original jurisdiction in patent cases throughout the country, and with enough judges on the bench to take up promptly all the cases disputed. With that court we should very soon reach the point that Mr. Steuart and we all think important, namely, that of sifting out the worthless patents. If anybody is interested in finding out what the true actual value of patents is it is the parent companies—as well as the lighting companies. As far as we are concerned, we would be very glad to-day if every one of Mr. Brush's patents could be passed upon by a competent authority, and a decision made in ten days from this time, and every patent that we have got that is worthless laid upon the shelf, and every patent that we have that is valuable endorsed with its right figure. Now that certainly could not be unfair to anybody, and as the relations of parent to sub-companies

named on this programme here, arose originally from patents, such a settlement as that would go far toward harmonizing any differences that might exist between them.

There is occasional mention of our contract relations with the sub-companies, and that I presume is true of all the parent companies—manufacturing companies. I only speak for our own company. I believe we have had comparatively little difficulty on this subject. In all our contracts, so far as I can remember, a provision is added at the end which stipulates that all questions of dispute may be settled by arbitration. This we all recognize as a fair method of reaching any decision. That provision has been, as I say, attached to every contract. We have so far, in an experience of about ten years, had one arbitration only, and that was abandoned before it was finished. As far as we are concerned, we are willing at any time to submit any differences of opinion, whether important or not, to arbitration, either of one man, which I think the best, or of three. If you talk with a lawyer on the subject of arbitration, he will tell you, as a rule, that an arbitration of three is not a satisfactory arrangement, for the reason that where the arbitration court is composed of three members, one is a partisan on one side, the second is a partisan on the other side, and the third is an arbitrator between the other two, but is not a judge, although in the position of a judge. Hence we have come to the conclusion that the fairest, quickest and best method for an arbitration is to select, if it be possible, a judge as the man and leave it entirely to him. I think that is the shortest and easiest method, and if we were to have an arbitration between our company and any sub-company, we should urge that plan as being the best one.

These are the points that occurred to me following what Mr. De Camp said on this matter. I do not know that there is anything else I can communicate of interest.

Mr. De Camp remarked that Mr. Stockley left out one point. He was very glad to hear the remarks that gentleman had made already. They might naturally suppose that Mr. Stockley would assume that the proposed bureau would be rather antagonistic. He would, if he were in Mr. Stockley's position, and he was very glad that Mr. Stockley took the view expressed. It was an exceedingly liberal one. But the question they were all interested in was that of invasion of territory, and he knew Mr. Stockley deprecated such action as much as any one. He now invited Mr. Stockley's public utterance on that point.

Mr. Stockley: I think there is nothing in the world that promises better in the way of business than electric lighting; but in order that the promise should be realized, property should be made secure. I might take an illustration of a man in the dry-goods business, doing a good, honest, square trade, selling goods for little more than they cost, but making money. Suppose some concern desiring to get into the field simply and divide the business, should do it by coming in and selling very far below the price at which goods could be produced for, demoralizing all the trade, and hoping to be bought out or provided for. Now, there is a company that illustrates that in this country, not more than a thousand miles from Detroit; it was getting fair average prices for its city lights. It made a bid for city lights at 6 cents an hour. The council desired bids in that shape. An opposition parent company, not a local company, came into this field and said they wanted to go into the business. They went to two or three people, but could get no capital positively pledged. When the time for the contract to be awarded came, they made a bid in their own name to run the lights for $3\frac{9}{10}$ cents per hour. How they selected that particular price nobody knew; perhaps they thought the other company would reduce their bid down to 4 cents, and then they would be below that. They got the contract. The council decided on the face of the matter. The parent company went ahead to put in the apparatus. After a while they convinced three or four people there in the town that there was money in it. They got them to put their capital in it, and the result is there are two companies in that town, neither one making a penny, sinking money, probably; the public is paying outrageously low prices and nobody is getting any benefit except the parent company, possibly, on the apparatus sold. Now the Brush Company deprecates that sort of action in the strongest way, and has never adopted it in any way. Some of our agents, I am informed, have done so, individually, as a matter of retaliation. It is questionable whether that is true, but I have heard it stated. It is only human to suppose it would be done. But I know our company would be pleased, and other parent companies looking to their interests would be pleased that a proper method of extending business should be adopted. The proper way is certainly not to attack business already established. That is our decision in the matter.

Mr. Upton said that his company was not interested in any electric light company in any way, shape or form, and while Mr. Stockley's view was all right from the standpoint adopted, he himself did not think it met the facts and conditions. He believed that where there was one parent company in the field to-day in ten years' time there would be ten, and the man that made the cheapest and best apparatus would get the business. It was a case of the survival of the fittest. He believed, too, as an instance of the way the business was developing, that every gas company in New England was going to put in electric light plant. He thought it was impossible to stop this general movement, and it had got to be met on a basis of dollars and cents.

Mr. De Camp made a very able statement as to the difficulties that beset the older lighting companies from the rapid improvements in apparatus, and the form of their contracts made before the real nature and expenses of the business were understood. He also pointed out how, without a dollar actually invested, competitors came in to beat down fair prices or to filch the business that had been built up through years of trial, worry and hard work. He very strongly deprecated any such rivalry, as being far from legitimate. He did not think that gas companies were going very far into that either.

Mr. Weeks said that he was not authorized to speak for the Thomson-Houston parent company, but he might state that after the close of the last convention he called upon Mr. Coffin and Mr. Barton of that company, and spoke to them in regard to this matter of interference, and argued with them that it would be well for all parent companies to enter into some kind of an agreement pursuant to which their territorial rights would be respected. Messrs. Coffin and Barton told him that they were ready at any time to enter into such an agreement with any company owning fundamental patents.

Mr. T. C. Martin then read the following paper on

THE OPERATION OF MOTORS FROM ELECTRIC LIGHT AND POWER STATIONS.

When I find that more than one hundred electric light companies have the words "and power" in their titles, I come to the conclusion that they mean something by it, and the drift of the paper I had the honor to present, as a proxy, before the association last February on motors, was that it is worth the while of electric light men to pay attention to the questions involved in the distribution of power electrically. The "faith" exhibited by a high-sounding corporate name can be profitably seconded by "works." Electric light men, for the reason that they, more than any others, are familiar with the modern problems of heavy electrical engineering, are the best qualified to introduce electric motors to public notice, and the further I investigate this subject the more deeply do I become convinced that there is hardly a locality where an electric light plant exists in which also electric motors cannot be installed remuneratively.

At the present time, the feeling with regard to motors is in many quarters so sanguine that it amounts to a "boom." Now "booms" are just as bad in their way as inflation of the currency, or any abnormal display of high spirits and strong imagination. But in the case of electric motors, the "boom," if there be one, has been slightly delayed. Historically, the electric motor anticipates in practice the electric telegraph, the electric light, the telephone and the storage battery, yet to-day it has less importance than any of these, except possibly the last. I venture the opinion that in the near future the relative prominence of these applications will be somewhat changed. Perhaps it is well that the greater perfection of the electric motor has been delayed, and even to-day is tardy. Its ultimate success has depended upon improvements in primary batteries, in secondary batteries, in dynamos, steam engines, boilers and furnaces burning cheap fuel, upon improvements in wires and in line construction, upon the development of modern ideas of urban convenience, and in no small degree upon the multiplication of small industries requiring power minutely subdivided, yet, like the Eastern genii, ready at beck and call. I might, indeed, assert that the electric motor had, for its full fruition, to await the growth of the modern idea of centralization, through whose influence we are led to depend on central stations and agencies for light, time and heat; ice, water and air, "patent inside" newspapers, associated press dispatches, and almost every one of the comforts, conveniences and nuisances specially distinguishing modern life from that of the days gone by. The electric motor is the latest, in many respects the most effective realization of the idea of centralizing productive effort with the view of gaining the greatest good for the largest number, yet leaving the individual a larger freedom than he ever enjoyed before. Mr. Henry George, the economist and social reformer, told me the other day that he feared electricity would be monopolized like other forces, and that though the electric motor would enable manufacturing producers to work cheaply on a small scale and widely scattered, it could only mitigate the evils of the private ownership in land that now crowds our working population into dens and hives near their places of employment. I am a little more cheerful and optimistic than he. While I am not one of those who arouse Mr. Matthew Arnold's anger by looking upon railways, cheap postal service and electrical applications as marks of the millennium, I do prize them, especially electricity, as means to the end of gratifying the instinct of man for expansion, and affording him the opportunities that enlarge and secure his existence.

That way lies the social philosophy of the electric motor, whose wires can be run through a key-hole, into a tenement or out through country districts, and whose uses are common to all in need of power. Now a few words on the practical side of the subject. At the present time, the application of the electric motor divides itself into two departments, both of interest to electric light men, that of street railways and that of industrial work. A brief glance may be taken at each department separately and, first, at that of street railways. As nearly as I can estimate, with close figuring on each of the roads, over a million passengers have already been hauled by electric locomotives in America, while the number in Europe far exceeds that. Such a fact is significant in itself in these days of rapid change of system and greater attention to comfort in travel. Probably we shall not have to wait for an epizooty in the car stables before we see a very general adoption of electricity in the propulsion of street cars. The Baltimore Daft electric street railway, over which many of you traveled in heavy slush and rain last February, is now in its second year of operation, without any electrician in charge, and contemplating an extension. The cost of electric power per day is $12, as compared with $18 for horses under the old system; and the cost per passenger last year was .83 cent, or about half, as compared with 1.55 cents in 1884.

The Daft system is in use at Revere Beach, Mass., and is now being introduced on the street car lines at Los Angeles, Cal., and elsewhere. The Van Depeole system of electric locomotion is in use in or under contract for several cities, among which may be named Minneapolis, Montgomery, Ala.; Windsor, Ont.; Detroit; Scranton, Pa.; and Appleton, Wis. The figures will, I hope, be presented by Mr. Van Depeole himself, showing results of great economy as compared with mule or horse-power traction. In Philadelphia, Mr. H. M. Schlesinger has a good system operating on a half-mile track, and one that will be introduced at more than one point early next year. The Bentley-Knight system that was successfully tried in Cleveland last year, can now be seen in operation at the Providence Locomotive Works, Rhode Island. And last, though very far from least, is the system of Mr. Frank J. Sprague, who has worked out his inventions and plans with a thoroughness and ingenuity that must awaken admiration in every one. I am not at liberty just now to explain the details of the system, they will probably be made public in a short time.

To show what is thought of elevated electric railways, I may quote Prof. Henry Rowland, the distinguished physicist of Johns Hopkins University. As to this system he says: "Altogether there is no doubt in my mind that Mr. Sprague's method of working motors for electric railways is thoroughly scientific, and that it has many advantages from a practical point of view. It is also decidedly more economical than any other that has been brought to my notice, and will certainly accomplish what is required in such a case, namely, the moving of a train of cars from one station to another in the least time, with a given maximum speed, and with the greatest economy of power and least wear and tear of machinery." I should add that Mr. Daft is also resuming his work, with heavier motors, on the New York elevated roads.

Mr. Sprague has for some time past had a car propelled by his motor running on the Thirty-fourth street branch of the New York elevated railroad, ten blocks away from the generating station. I mention these facts because many minds are at work on electric street railway problems, because the enterprise will be carried out, and because electric light men operating large stations, as many of them now do, know that they can easily generate and handle the large currents necessary. In fact, if they will seize their opportunities, many of the street railways will soon be operated electrically by electric light men. The whole new motor business is legitimately theirs, just as the electric light field and that of telephony opened up new careers to telegraphers. In electricity, we rise on the stepping stones of our old selves to greater things. Some electric light men will naturally say that they are at present as busy as they need be, and it is true that the electric light man has yet to be evolved who can say, with Walt Whitman, "I loaf, and invite my soul." Still, I think that most of you will in a few years be interested directly in street-car operation.

The second department in which motors are being used to-day is the industrial; although, even already, the industrial work is subdividing itself. The number of small electric motors in use to-day industrially in this country may be put at certainly far beyond 5,000. Of the old, familiar Griscom motor, several hundreds have been put in use; of the Stockwell motor, about 1,000 have already been called for; Daft motors are in use in New York, Boston, Worcester, Providence, Coney Island and other places. Sprague motors are running in New York, Chicago, Boston, Pittsburgh, Des Moines, Elgin, Oskaloosa, Shamokin, York, New Brunswick, Fall River, New Bedford, Milford, Taunton and Lawrence, Mass.; and there are also a great many Brush, Baxter, Pendleton, Bergmann, Keegan, Edgerton, Reckenzaun, Ayrton and Perry, Diehl, Roberts, Crocker and Curtis, and other motors in use all over the country, on work of the most varying nature. A few exemplifications of their use by electric light companies will perhaps be interesting. In Philadelphia the Brush company is running about 250 Stockwell motors and one 1 h.-p. motor. The small motors are chiefly on factory sewing machines, but some are on fans and jewelers' lathes. They are generall giving satisfaction, and if the company could only get its wires to the places wanting motors, the number in use would be quadrupled. Mr. M. D. Law, the electrician of the company, who has charge of this department, operates 18 of the small motors with the power required for one arc light, if they all of them run together at one time; but in practice he has no trouble in running from 30 to 40 with the same power, as they are never all on together. The charge for the current is $5 per month for the first four motors and then $1 per month for each additional motor. All motors are wisely sold outright, the company only renting the current for them. At the Brush-Swan station, Cheyenne, Wyoming, Mr. E. P. Roberts is building his own motors and finding a wide variety of use for them. One runs an evening paper, another a gunsmith's lathe and emery grinder, and two others cut up sausage meat for butchers. In the case of the gunsmith, the charge is ten cents per hour per horse-power. The motors are run from Brush storage batteries on the day incandescent circuit, and at night from the dynamo, the potential being 100 volts. The Brush station at Baltimore has been putting out motors, chiefly of the Baxter and Edgerton types, quite extensively. The Baxter motor there has been running on a great variety of work, on arc circuits, with good profit, and is said to be very economical of power while regulating with the utmost closeness under all variations of load. At Germantown an Edgerton motor is running a Gordon press most successfully. In Detroit the Brush Company is also running several motors.

At Des Moines, Ia., the local Edison Company is running a number of Sprague motors. The motors there are sold outright and the current is generally charged per meter. One of these motors, of three horse-power, is used in a livery stable to run the elevator for hoisting the buggies and hay, for pumping water and for brushing down the horses. One runs a scissors grinder's outfit, one a drug mill, one a polisher in a plating establishment, and, curiously, one the generator in the Telephone Exchange. Several elevators now run by water will have electromotors this fall. Mr. F. H. Whiting, the manager, says: "I think that the motors in reasonably large towns can be made to go a long way to the paying of running expenses of those stations that have to run all the time, as in the incandescent business."

At New Bedford, Mass., seven Sprague motors have already been installed within a short time by the local Edison Company, and are now used in silver-plating works, on ice cream freezers, on coffee grinders, bookbinders' cutting-presses, on a hydro-extractor in dye works, and on a hair picking machine. These motors earn easily altogether about $40 a month, on the regular incandescent circuit, the current being supplied at lamp rates, 1¼ cents per 16 c. p. lamp hour, and measured by meter.

In Boston, the Sprague Company is running a large motor service on a circuit embracing a three-quarter mile radius from its station in Bumstead Court, the motors ranging in capacity from ½ h. p. to 1½ h. p. To enumerate all the kinds of work done would be to mention most of the machines for small work heretofore driven by steam engines or foot-power. The motors are sold outright to the customers, and $125 per horse-power per annum is charged for the current or power service. For elevator work, there are special rates depending upon the average use by the consumer. The amount of average consumption is determined by ammeter and voltmeter, and from that determination a contract price is made. The intermittent use by the consumer is found to be an important factor in supplying power, as not more than 37 per cent. of that sold is ever called for at one time, so that, allowing for the loss in transmission, at least double the engine service can be sold, provided the power is distributed in small quantities. From actual tests made by one company it appears that some few of the averages of power consumed run as low as 14 and 15 per cent., and Mr. Sprague tells me that the higher average of from 33 to 37 per cent. will apply not only to small powers, but is absolutely true of large powers, such as 40, 50 or 100 horse, where a number of these are operating together from a central station.

As an evidence of the feeling in Boston on the subject of motors, I may mention that the Merchants' Electric Light and Power Company, running 800 Thomson-Houston arc lamps, has voted to adopt, and is now equipping

for, the Sprague system. At Springfield, Mass., another actual electric power station will be established. The Springfield Steam Power Company, heretofore transmitting power by belting, shafting and wire cables, has now decided to distribute power by means of electric current, as giving a better and more economical service, as well as increasing the distance at which it can work. The change is being carried out at the present hour.

In New York a great many Sprague motors are in use. A large number of Daft motors have been in operation there for a considerable length of time, and I know from actual personal inquiry and observation that you could not get these customers to abandon the use of their motors. One instance deserves special mention. Mr. E. B. Stimpson, in Spruce street, well known as an inventor and manufacturer of fine machinery for the shoe and stationery trades, has for about a year been running four floors of his workshop with a Daft motor. Some of the machines belted to the shafting on the various floors are quite heavy—drills, lathes, planers and the like; others are extremely fine and delicate; but for all of them, Mr. Stimpson tells me, the electric power has been sufficiently steady. He had formerly a ten-horse power vertical engine, with boiler on the top floor of his building, and had the usual trouble with engineers, coal, ashes, dust, oil, vibration and great heat in summer. Now, in striking contrast, a little six horse-power Daft motor stands on a small wooden base, close up against the disused boiler and engine, making so slight a noise that it in no way interrupts conversation. The motor runs the day through, and all the attention it gets is a very occasional visit and wipe on the commutator from a motor man, who also has charge of a number of other motors all around the neighborhood. Mr. Stimpson pays $12 a week, and I doubt if there is a manufacturer in New York to-day better pleased with his power than is Mr. Stimpson with the electric motor he has been using so long and with such good results.

A great many motors to-day are operating very successfully with primary batteries, and that field will grow.

In the incandescent business, the plant must be kept running all the time, so that the consumer can always have his light when he wants it. Hence I look upon motors as the most important auxiliary to-day for incandescent lighting, and I think that in many an arc station, too, they will solve the financial problems of day lighting. But whether that be so or not, what I have said shows, I think, that the day of the electric motor is upon us.

Mr. DeCamp remarked that in Philadelphia they simply rented out the current. People were paying the prices asked, and would continue to do so, though he had not expected it. There was a demand for motors, and it was for the lighting companies to see that they can supply them with profit. He still had some doubts, but they applied to the manufacture of the motors. In his judgment, it was now only a question of the durability of the motor.

Mr. Upton gave eloquent expression to his well-known views on the future of electric power, and said that electric light men could make two dollars from motors where they now made one dollar from light. He mentioned the fact that a number of companies in New England were equipping for the new business, and instanced especially the case of Mr. Gilbert and Mr. English, who certainly were not putting in a 125 h. p engine to play with, but because they saw money in the business. This view of the future applied not only to motors for industrial work, but for railways, though in that respect a good system of underground circuiting, so as to run through the streets of cities, was necessary. The Ries system of that kind was estimated to cost $20,000 a mile. Mr. Van Depoele said he could do it for $7,000, and a gentleman in the convention had a system that it was alleged would cost only $1,000 per mile. With that, or when that time arrived, nothing was lacking for perfect success everywhere.

Mr. De Camp raised the interesting question as to who should own the motor; whether it was best to sell outright and then rent out current, or to rent the motor to parties wanting them. He was not prepared to advocate that the companies should own the motors; and if they were sold, the purchasing parties would be prompted by ownership to take better care of the motors. In that event, however, the owner would have to be near their circuits. He knew of a case now where a man had bought a motor and had moved away from the circuit, and so could not get current to run it. Mr. De Camp also wanted more certainty as to the durability of the motor.

The next question discussed was as to the running of motors on incandescent circuits or on arc circuits. Mr. Harding gave a very satisfactory account of his experience in New England with Sprague motors, built for incandescent circuits. He had no sparking on them, and none of them had burnt out.

Mr. Stockley said that the Brush Company believed in the motor business most thoroughly. They were building motors from 2 h. p. up to 100. Their attention had been called very seriously to one branch of the business, that of taking the power of waterfalls and carrying it a distance of 10, 15 or 20 miles, and thus using large amounts of power now wasting—say up to 50 or 100 horse-power. It was a branch of the business for all of them using water power. The Brush Company was ready to furnish motors to run with absolutely steady speed, with and without load, from 2-horse up to 100, and with an efficiency of 70 per cent. Every part of the mechanism was provided for permanent use.

In reply to a question from Mr. Law, Mr. Harding stated he was running his motor on the regular incandescent circuits. With the three-wire system they operated on a two-mile radius. He thought motors would run best on incandescent circuits.

Mr. Law stated that in Philadelphia he ran his motors on the arc circuits. It would not yet pay him to run independent circuits for them. It would involve double wiring.

Mr. Baxter said: The remarks that have been made here seem to indicate that a motor can be made to meet all the requirements successfully to run on an incandescent and an arc circuit. My experience has been that a motor can be made to run more safely on an arc circuit than on an incandescent, for the reason that the current is more regular. When a motor is standing still (that is, a properly constructed motor), it has a lower resistance than when running. That is to say, when the motor runs, there is a rising potential between the binding posts, which is due to the counter electromotive force set up by the motor. Consequently, each motor which runs in multiple arc is arranged so as to carry the current safely when it is doing its work. If it stops and no provisions are made to guard against too heavy current running through the motor, it will burn up. On that account safety plugs have been provided to guard against such a thing happening with motors on incandescent circuits. The thing chiefly to be looked after is the prevention of the sparking and the consequent burning up of the brushes. This is a difficulty which with most motors on arc circuits can be overcome. For instance, in the motor which I have in the window of the Council Chamber here, and runs that 36-inch fan, it has been overcome. I think that motors for arc light circuits are just as successful as those for incandescent circuits.

Mr. De Camp: You have turned your attention in the direction of motors, with a view to adapting them to arc circuits?

Mr. Baxter: No; we make them for both circuits, but there are probably a hundred circuits running arc lights to one running incandescents.

Mr. DeCamp: In running your motor on an incandescent circuit, would you have to make any change in the construction of the motor?

Mr. Baxter: Yes, it would have to be wound differently. In regard to oiling the commutator, that ought not to be a matter for consideration. They ought to run without oiling. I will guarantee my motor to run four months without oiling in any way. I will guarantee them to run night and day continuously for one month without being oiled, under a glass case, if you choose.

Mr. Law: Without being oiled?

Mr. Baxter: Yes.

Mr. Law: At the rate of 480 revolutions per minute?

Mr. Baxter: Yes, sir; at the rate of 4,800 revolutions per minute.

Mr. Law: Then you are our man.

Mr. Upton said Mr. Sprague had informed him that he could run his motors successfully on circuits 12 miles long.

Mr. Sharpe mentioned that he had become interested, as a business man, in the Edgerton motor, from first seeing it work in his own factory. The Edgerton motor would run on both arc and incandescent circuits successfully and economically. There was nothing, practically, to wear out; the attendance required was the minimum; any girl could see in the morning that the connections were right and wipe the commutator. Mr. Sharpe closed a very able and vigorous speech by pointing out how the motor saved the wear and tear of human flesh and muscle, and was "a perfect God-send" to those who had to run such articles as sewing machines all day long. He knew the electric motor to be cheap, durable and simple in construction, and that was the kind of motor his people were introducing for manufacturing purposes. In reply to Mr. Pope, he mentioned cases where the Edgerton motor had not been touched for a year.

Mr. Duncan spoke very hopefully of the new motor business, from the little experience he had already had in it. In one instance, he was running with a motor the generator in the telephone exchange. He thought their carbon trimmers could very easily be taught to give an eye to the motors on their rounds, as there was little to see to, so long as the motor is kept clean and the brushes are in order.

Mr. Law spoke very encouragingly from his two years' experience with the Stockwell motor.

Mr. Boyer said the subject was very interesting to him, and the outlook was hopeful. He thought that the companies should sell the motors outright.

At the close of the discussion on electric motors, Mr. Stockley stated with regard to the question of small consumption of coal in getting electric current, that the Brush Company was making some very thorough tests at Cleveland, with the closest watchfulness, of the validity of the claims made for the Triple Thermic Motor.*

Mr. Upton denounced the triple thermic motor in round phrases, without mincing matters, as an exploded idea, that had lost all confidence in New England, and which had had heaps of money put into it without result. Mr. Stockley remarked that the Brush Company proposed, in the interests of electric lighting, to make a most searching investigation for itself, under the supervision of Mr. Brush.

Mr. J. A. Pentz then read a paper on "The Transmission of Power to the Dynamo," which, together with the discussion thereon, pressure on our columns prevents us from publishing this week.

Mr. Weeks said: Feeling that such resolutions have lost whatever meaning they originally possessed, we, as a body, extend no "vote of thanks" to the authorities or to our good friends of the electrical fraternity in this city for the ample apartments placed at our disposal, or the generous provision made for our entertainment. But our appreciation of these kind offices is none the less full and sincere, and we shall carry away with us the most pleasant memories of our visit to this delightful and hospitable city.

Although many of the leading members of our association were unable to be with us, this convention has been one of increasing interest and profit, a fact full of encouragement, as it proves that our organization is based upon a living principle that the National Electric Light Association is a resultant of the "needs of the times," rather than an ephemeral association of individuals brought together by chance or personal selection.

As we have finished our business as per programme, I declare the convention adjourned.

THE EXHIBITS.

The Jenney Electric Company, of Indianapolis, exhibited two Hickley incandescent lamps, one of 300 and the other of 400 candle-power. It is claimed by the manufacturer of this lamp that it produces one candle-power for 1¼ watts, and the behavior of the lamps exhibited seems to justify the claim. The lamps and the attachments were very tasteful, and attracted considerable attention.

The Forest City Carbon Co. exhibited their Austrian-American cored carbons. As is generally known, these carbons have a soft composition core, with certain chemicals added to the core mixture which, it is claimed, reduces the resistance of the arc ten per cent. This carbon also throws the rays of light down instead of up. The carbons were exhibited in both Thomson-Houston and Brush lamps, and the steadiness of the light was marked by all.

The Little-McDonald cut-out is an attachment for facilitating the use of incandescent lights on arc circuits. It is so constructed as to throw in an automatic resistance when the lamp breaks or is turned down, keeping the balance of the lamps at a normal candle-power, and prevents the opening of the circuit in case all the lamps on a group should fail. This cut-out was exhibited in connection with both the Brush-Swan and Sawyer-Man lamps.

The Callender Company showed specimens of "bitite" wires and cables.

Mr. Clark B. Hotchkiss exhibited the celebrated "kerite" wires and cables, and kerite tape.

The Western Electric Company were present with an assortment of insulated wire and cables, and also showed samples of their magneto bells and galvanometers for testing purposes.

The Okonite Company displayed samples of their various wires and cables.

The Electrical Supply Company, of Chicago, exhibited the Wallace carbons, the "perfect" lightning arrester, Thomas cut-out, insulators, tapes, wires, etc.

Mr. W. B. Cleveland showed many samples of his electric light switches, connecting buttons and safety cut-outs.

The Edgerton Motor Company exhibited three of their motors of $\frac{1}{12}$, ¼ and ½ h. p. respectively. The $\frac{1}{12}$ h. p. motor was shown running a ventilating fan; the ¼ h. p. was taken apart and exhibited for the purpose of showing the effects of over a year's use on an arc circuit; the ½ h. p. motor was exhibited with a brake for the purpose of testing its power. This motor developed fully a half h. p., and all the motors attracted attention.

The Hardy traction motor was exhibited by Mr. George S. Bowen, a complete model being shown. This motor seems to be very practical and created much interest.

The Chemical Electric Light and Power Company exhibited 16 cells of Volta-Pavia battery running five 10 c. p. incandescent lamps. The lamps were so arranged that any one could be lighted alone or turned out without affecting the candle power of the others in the least. Any particular lamp could be started alone, or with the rest, as desired. This primary battery system shows considerable development.

The Leggit motor, a very ingenious machine, was exhibited and shown in operation attached to a sewing machine.

The Sun Electric Company, of Woburn, Mass., had a very complete exhibit of their system of incandescent lighting as operated upon arc circuits. A distributor and complete equipment were shown and the current was supplied from the local Brush Company's central station, the apparent reliability and simplicity of this exhibit elicited the commendation of many. In another room was also placed an exhibit of the same company's "Regina" equipment, consisting of multiples of 125 c.-p. lamps which gave satisfactory results.

The Baxter Electrical Company, of Baltimore, exhibited three of their new motors, two small ones and one large one. One of the small motors at the hotel ran a sewing machine and showed its adaptability to the purpose. Its action is completely under the control of the operator, who can arange the speed as desired, from the slowest desired movement up to the greatest velocity the sewing machine will stand. The other small motor drove an 18-inch exhaust fan and developed about $\frac{1}{10}$ horse-power. The large motor was located in the Council Chamber and successfully ran a 24-inch fan. This motor developed ¼ horse-power. This large motor is provided with an automatic governor, and its regulation is almost as perfect as that of the best steam engines.

Morrison's Electrical Works, of Baltimore, exhibited a new volt and ampère meter which attracted much attention. In this instrument a constant magnetic field is employed of sufficient strength to be unaffected by any variations of terrestial magnetism. This constant magnetic field is obtained by employing permanent magnets, very carefully constructed. Suspended at the center of the field is the needle, to which a pointer is attached for the purpose of reading the deflections, the pointer passing over a scale which is divided into degrees. The position of the needle with reference to the coils is that adopted by Gaugain. The coils are two in number, one of copper tape and the other of very fine wire, the former being used when the strength of current is to be measured, and the latter when the electromotive force is desired. In measuring ampères the whole current is sent directly through the tape, but in measuring the electromotive force only a portion is shunted through the fine wire.

Some well-made plug switches for central station work and a number of phosphor-bronze brushes for dynamos formed the remainder of the exhibit.

The New England Glass-Works were represented by Mr. E. D. Libbey, of Boston.

The Washburn & Moen Manufacturing Co.'s exhibit was very neatly arranged and included samples of the various grades of hard and soft copper wires.

The Gray Patent.

A dispatch from Washington announces that a bill in equity has been filed in the District Supreme Court by C. G. Beryman for Henry C. Strong, of Chicago, against Robert B. Vance, Acting Commissioner of Patents, and Elisha Gray, for an injunction to restrain the issuing of a patent to the latter. The complainant states that he is the inventor of the railway electric telegraph and telephone, and applied for a patent May 18, 1877; that this application has been kept alive by amendment to claims, etc.; that Gray subsequently filed an application for a patent for "multiple telegraph," which, he alleges, was by trickery and deceit stolen from him, and is nothing but a reproduction in principle and design of his machine and invention. He charges that by undue influences and by complicity with the examiners, Gray is about to receive a patent; that the issuing of a patent to complainant is delayed by Gray's influence, and the patent to Gray is about to be issued by fraud and collusion with the officers of the Patent Office, and if so issued, will greatly injure and delay him, and necessitate long and tedious litigation on his part. He further alleges that he is entitled to official action on his claim, and asks an injunction and relief. Judge Hagner set the first Monday in September at 12 o'clock for a hearing.

* See illustrated description in THE ELECTRICAL WORLD, June 5 1886.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Sept. 6, 1886.

The Sonneborn Rubber Comb and Novelty Company, of 63 Leonard street, this city, and Morrisville, Pa., have lately made extensive additions to their manufacturing plant to enable them to keep pace with their orders in the electric line. They are now fully equipped to furnish hard rubber in any shape, such as sheet, rod, tubing, mold work or special pieces for manufacturing purposes. The company has been engaged in the manufacture of hard rubber for thirty years and is fully acquainted with the wants of the trade and thoroughly familiar with all hard-rubber goods, as applied to mechanical and electrical purposes.

Cabinet work for electrical purposes is a specialty with the Union Wood Works, at No. 59 Ann street, this city. Mr. Robert Patterson, the proprietor and successor of George H. Brown, is a gentleman of long and practical experience in this line of work. This, together with the superior facilities of the establishment, enables him to turn out work of the best quality at comparatively low figures. Manufacturing companies whose appliances are in part formed of cabinet work, would find it to their advantage to write him for terms.

The vibrating box bell manufactured by Messrs. E. A. Wildt & Co., of No. 83 Murray street, this city, and described in your last issue is meeting with great favor, as it makes the work of inspection easy; the whole mechanism being contained in the removable cover. I may add that a patent has been applied for on this novel arrangement of the bell.

Incrustation and sediment in boilers has always been a source of trouble to steam users, and the frequent cause of damage to boilers, loss of fuel, and the primary cause of most explosions. All of this may be avoided by the use of the Hotchkiss mechanical boiler cleaners. The successful operation of these boiler cleaners is fully attested by engineers and many firms throughout the country who have used them for years. Havemeyer & Elder, the sugar refiners of Brooklyn, after a thorough test, ordered one hundred of the boiler cleaners and have at present in use sixty of them. Electric light companies situated in localities where hard water is prevalent will do well to give these cleaners a trial.

The Electrical Supply Company, of No. 17 Dey street, this city, has just issued a handsomely illustrated catalogue of 158 pages, which contains a full list of the large variety of goods handled by them. It would take me too long to go into details, but I may state briefly that there is nothing, from a telegraph pin to the finest galvanometers, that is not handled by the company. The catalogue should be in the hands of every dealer and consumer.

The E. P. Gleason Manufacturing Company make every description of etched, cut, sand-blast, flint and colored globes and shades for electric lighting. They have every facility for supplying these goods in any quantity, and for turning out glass-work to any desired pattern.

Mr. J. S. Watt, of 81 Fulton Street, N. Y., manufactures district telegraph cases in any desired style, and always has the standard forms in stock. Electric light hoods of all patterns, and special designs to order, are also among the list of his products.

White lead manufactured of pure materials throughout makes an excellent insulating compound for electric lighting and underwriters' wire of all kinds, for outdoor and interior wiring. The white lead, being impervious to water, makes the wires perfectly water-proof. In its manufacture the bare copper wire after being braided is carried through a vat of white lead somewhat diluted, which soaks into the crevices of the braid, and prevents all dampness from reaching the wire. The Atlantic White Lead and Linseed Oil Company, of 287 Pearl Street, this city, have long been known for the high quality of their products and wires covered with their white lead will stand the test of time without cracking or peeling, as is sometimes noticed on electric light lines.

Manning, Maxwell & Moore, No. 111 Liberty Street, New York, manufacture every appliance for a steam plant in ejectors, injectors, steam gauges and valves. To those applying therefor they will send a complete catalogue of 500 pages, fully illustrating all their goods.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Sept. 6, 1886.

The New England agency of the Sprague Electric Railway and Motor Company has just fitted up commodious and centrally located offices at No. 55 Oliver street.

The present offices at the power station, Bumstead Court, off 23 Boylston street, will continue to be occupied by one or two officers of the agency; but Mr. Harding, the manager, will probably make his headquarters at the Oliver street offices.

An isolated incandescent light plant of 200 (16 c. p.) lamps has just been started up in "Marston's," on Brattle street, one of Boston's largest restaurants. The system of lighting used is that of the Thomson-Houston Electric Company; the engine from which the motive power is derived for running the lights, elevator, fans, etc., was made especially for this plant by Messrs. C. H. Brown & Co., Fitchburg, Mass.

The New England Wiring Company, of this city, has been highly complimented in and outside of electrical circles for the painstaking and handsome pieces of work done in this city and elsewhere in this section. Among the most noticeable and praiseworthy of the wiring contracts recently finished in this city by the company are the enormous and laborious undertakings at the new building of the Massachusetts Hospital Life Insurance Company, on State street, the Massachusetts State House and the Adams House.

The Peerless Pressure Recording Gauges, manufactured by Mr. S. P. Jones, of this city, are becoming more and more general in use on steam boilers of electric light stations in New England and throughout the country. The parent Edison Company purchased a large number of these gauges, and after using them for some months in its factory and in several of its stations and plants, wrote to Mr. Jones a very nice letter, in which the Peerless gauge was referred to in very complimentary terms.

At Melrose, Mass., a very enterprising and energetic gentleman, by the name of Plaisted, recently obtained a sufficient number of subscribers among the business men of that town to enable him to install an electric light plant. Twenty-five commercial lights are now in use, and orders are already in hand for that many more.

The report comes from Pawtucket, R. I., that the local electric light company of that thrifty little city has purchased the old Le Favour Mill property, and will equip it with dynamos, engines, etc., for the purpose of lighting stores, offices and residences with incandescent lights.

A company is being formed in Pittsfield to put incandescent electric lights into the stores and a good many merchants have subscribed for them. The present Pittsfield Electric Light Company, who control the arc light plant are talking of adding several incandescent lights of the Thomson-Houston pattern, and also new facilities to their present plant. The satinet mill of the Pomeroy Company is to be equipped with about 100 incandescent lights, as their mill there has to be run night and day to supply the lower mill, and Tillotson & Power are going to have 250 in their woolen mill on the Barkerville road. Some of the other manufacturers in the town are talking of equipping their mills with these lights.

The new station of the New Britain Schuyler Electric Light Company is now finished and in full operation. The building, situated at 167 Main street, is a one-and-a-half-story brick fireproof structure, divided into two main apartments. In the boiler room, which is 45 × 30 ft., is set a 100 h.-p. "Fitchburg" boiler. The dynamo and engine room is 45 × 50 ft. A 50 h.-p. "Fitchburg" engine, belted to counter-shaft, and a New York Safety Steam Power Company's engine of the same power, belted direct to the dynamo, furnish the necessary power for running the three generators.

One 45-light dynamo (1,200 c. p.) furnishes light for private consumers, and two dynamos of 30—2,000 c. p. lights each—are used for running the street circuits, the three circuits aggregating 18 miles of line wire.

The whole station is a model of neatness, and it is without doubt one of the finest equipped electric light plants in the State.

The officers of the company are as follows: J. M. Spring, president; R. J. Vance, secretary and treasurer; C. O. Case, superintendent; L. C. Whitney, engineer; W. J. O'Dell, chief lineman.

Messrs. Paine & Francis, sole agents for Maine, New Hampshire, Vermont and Massachusetts of the Edison United Manufacturing Company, report business in their line as very satisfactory. Since July 12, 1886, the firm have installed in the district above named nine plants, having an aggregate of 3,150 lamps. The most recent of the installations, included in the nine plants mentioned, are the following: A. G. Dewey & Company, Queechee, Vt., 150 lights; York Manufacturing Company, Saco, Me., 200 lights; Hon. Byron Weston, Dalton, Mass., 150 lights.

The New England Wiring Company, of this city, has been awarded the contract for equipping and wiring the above-named isolated plants.

The Citizens' Electric Light Company, of East Boston, Mass., has its hands full of business. It is at present furnishing 113 arc-lights, and orders are now in hand for nearly one hundred more. Until the lighting capacity of the plant can be enlarged, the company are compelled to borrow dynamos and lamps, or else disappoint a good many patrons.

Mr. Charles L. Bly, of Boston, has just finished the contract of putting in the fire-alarm boxes and running wires in Hyde Park, Mass., for the Geo. M. Stevens fire-alarm system. Disinterested individuals who have seen the work just completed by Mr. Bly, refer to it in very complimentary terms.

The Boston *Globe* recently contained the following interesting item:

Thefts of money from garments hanging in the clothes room of a Meriden (Conn.) factory led the electrician of the establishment to try to catch the hitherto undetected thief. He connected a pocketbook in the pocket of a pair of trousers with wires that terminated at a gong in a distant room, and so arranged the wires that the gong would ring when the pocketbook was moved. The pocketbook was moved, the gong sounded and the thief was caught.

The Tremont House is soon to be lighted throughout with incandescents off an arc circuit.

The Van Choate Electric Light Company, formerly of New York and now located on Columbus avenue, in this city, has again changed its personnel and management.

There are two corporations, viz.: the Shawmut Electric Manufacturing Company and Tremont Electric Manufacturing Company, doing business at No. 12 Mt. Washington avenue, that are reported to be practically owned and controlled by one gentleman.

The Synchronous Time Company, Room 4, *Herald* Building, this city, is about to issue its illustrated catalogue. Electricians and dealers in electrical supplies will do well to apply early for the handsome pamphlet.

The Wainwright Manufacturing Company reports having sold its exhaust feed-water heaters during the month of August to the following: Rutland (Vermont) Electric Light Company; Messrs. W. & B. Douglas, Middletown, Conn.; the Fitchburg Engine Company, Fitchburg, Mass.; Geo. H. Little, Peabody, Mass.; Melrose (Mass.) Pumping Station, and to several other parties in New England and in other sections of the country.

The Montpelier (Vt.) Electric Light Company is making rapid headway with the equipment of its plant; and it is predicted that electric lights will be burning in the streets of that town before Oct. 1. It has been decided to make temporary use of the village water-works, with the aid of motors as the source of the power for the plant.

The Hopedale Machine Company, of Hopedale, Mass, has just completed the extension to its factory, and machinery for screw work of all kinds will be set up at once. Twelve machines, capable of turning out at least 10,000 screws each per diem, are being made specially for this company.

On the 13th instant, a special town meeting will be held at Framingham, Mass., for the purpose of voting upon the proposition of the Suspension Transportation Company, of Boston, to erect an elevated railroad between the above-named town and South Framingham, on which the motive power will be electricity.

The Thomson Houston Electric Company is vigorously pushing toward completion the new addition to its factory building in Lynn, Mass. The business of the company is so rapidly increasing both in the arc and incandescent departments, that it is absolutely necessary for the manufacturing equipment and working force to be at least doubled, and that, too, within the next sixty days, in order to facilitate the fulfillment of contracts before the autumn business gets started.

As evidence of the remarkable rush of business being done by the Thomson-Houston Electric Company, the following summary of new orders that have been received since the 1st day of July, 1886, is given:

ARC LIGHTS.

3—45-Lt.	machines,	Brooklyn, N. Y.	addition.
3—10 "	"	Croton Aqueduct, New York	"
2—30 "	"	Manchester, N. H.	new.
1—45 "	machine,	Brookline, Mass.	addition.
1—45 "	"	Bangor, Me.	new.
1—30 "	"	Bristol, Ct.	addition.
1—45 "	"	Plainfield, Pa.	new.
1—45 "	"	Cleveland, O.	addition.
1—30 "	"	Memphis, Tenn.	"
1—45 "	"	New Bedford, Mass.	"
1—45 "	"	Santa Rosa, Cal.	new.
1—45 "	"	Marion, Ind.	"
1—45 "	"	Anderson, Ind.	"
1—45 "	"	Huron, Dak.	"
1—45 "	"	San Luis Obispo, Cal.	"
1—45 "	"	Amoskeag Co., Manchester, N. H.	"
1—45 "	"	St. Louis, Mo.	addition.
1—30 "	"	Birmingham, Ala.	"
1—45 "	"	Youngstown, O.	"

INCANDESCENT LIGHTS.

1—150-Lt.	machine,	Haverhill, Mass.	new.
1—150 "	"	Montpelier, Vt.	"
1—600 "	"	Cleveland, O.	"
1— 50 "	"	Day Cordage Co., Cambridge, Mass.	"
1—300 "	"	Terre Haute, Ind.	"
1—300 "	"	Southern Hotel, St. Louis, Mo.	"

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Sept. 4, 1886.

I was shown, this week, the largest belt it was ever my fortune to see. This belt is 64 inches wide and of double thickness. It will be used in the electric light station at New Orleans. Two other belts of large size, one 52 inches and another 40 inches wide, will also be used at this station. In fact, these latter belts are already shipped. Munson & Co. are the manufacturers of these belts, and I doubt if every manufacturer has the equipment for turning out belts of this size.

The Western Electric Company yesterday shipped the new multiple switch-board for the Cincinnati Telephone Company. The board is equipped for 2,000 subscribers, and has a capacity of 5,000.

The Shultz Belting Company, of St. Louis, recently received an order for 3,000 feet of their patent fulled belting.

The Chicago, Milwaukee & St. Paul Railway is about to adopt the induction system for telegraphing to and from moving trains on one of its divisions.

With the steady growth of electrical appliances for lighting purposes, there has been an equal advance and improvement in the manufacture of belting for conveying power to the dynamo.

The device of placing leather over the face of a solid woven cotton fabric, which process is used in the product of the Underwood Manufacturing Company, and known as the patent cotton-leather belt, has developed much practical worth. The following statement and references will at once command the attention of electricians and manufacturers.

The belt is formed by weaving several layers of cotton duck solid in one body, made moisture-proof by a process known only to the manufacturers. The cotton-belt is thoroughly run over large revolving pulleys, under uniform tension, to take the stretch out, leaving only the elasticity. The leather facing is all of English oak bark, long tannage of uniform thickness, especially prepared for this purpose, and after being thoroughly worked is cut into strips adapted to the width of the belts to be made, and while the cotton belt is under tension, it is then cemented in large hydraulic presses made for the purpose, by which the fabric and leather are firmly united. This simple process has brought before the consumer a belt superior to anything yet in use.

For dynamos, it is specially adapted, since: 1. It is perfectly and evenly balanced. 2. It is of even texture and without joints from end to end (unlike leather). 3. It is soft and pliable. 4. It runs perfectly straight; hence does not tread the pulley. 5. It hugs the pulley closely, owing to its perfect contact surface; hence it does not have to be run as taut as many other belts where there is necessarily a large loss of power. A belt possessed of these qualities does not heat the bearings, therefore, much power, otherwise lost, is saved. Nearly fifty electric light stations are now using this belting. Some of these are: Schuyler Electric Light Company, Hartford, Conn.; New Britain Electric Light Company, New Britain, Conn.; Middletown Electric Light Company, Middletown, Conn.; Danbury Electric Light Company, Danbury, Conn.; Marlboro Electric Light Company, Marlboro, Mass.; Columbia Electric Light Company, Columbia, Pa.; Skowhegan Electric Light Company, Skowhegan, Me.; Elizabeth Electric Light Company, Elizabeth, N. J.; Knoxville Electric Light Company, Knoxville, Tenn.; Richmond Electric Light Company, Richmond, Va.; Northampton Electric Light Company, Northampton, Mass.; Kingston Electric Light Company, Kingston, N. Y.; Wichita Electric Light Company, Wichita, Kan.

Lava insulators are giving so much satisfaction that the D. M. Steward Manufacturing Company, of Cincinnati, who manufacture them, report that they are full of orders, and will shortly be compelled to add additional machinery in order to keep up with the demand.

A company has recently erected a large circular building in Kansas City, on the corner of Eighth street and Broadway, intended to be used for giving a cycloramic representation of the Battle of Chattanooga, and the storming of Misssionary Ridge and Lookout Mountain. The whole building is to be illuminated by the Jenny electric light system of Ft. Wayne. The plant will be an isolated one of 35 arc lights. Just outside the building the Star Iron Tower Works Company have put up one of their triangular towers. It is 125 feet in height and will be illuminated with five 2,000 candle-power lamps. Just below the lights there will be a triangular sign for advertising purposes.

Another building is nearly completed at the corner of Seventh and Walnut street for giving a representation of the Battle of Gettysburg.

W. A. K.

THE TELEGRAPH.

Hoboken, N. J.—Mayor Kerr has under consideration a resolution of the council adopting a fire-alarm telegraph system for the city.

The Charleston Disaster.—The main office of the Western Union Telegraph Company in Charleston was badly injured. The batteries were destroyed and all the instruments ruined by falling bricks and plaster. An office has been opened about a mile and a half from the old one, and two wires have been placed in working order. None of the employés were seriously injured. At 5 o'clock in the morning of Sept. 2, all the operators were compelled to quit their posts and seek some rest. The excitement had been so great that for forty-eight hours they had obtained no sleep. The Western Union Company will forward to Charleston any contributions of money for the sufferers and any messages pertaining thereto free of charge.

To Discontinue a Suit.—Ex-Senator Conkling and ex-Attorney General Leslie W. Russell appeared on opposing sides in Supreme Court Chambers on Sept. 4. The motion was to discontinue a suit brought by Courtlandt Parker, of the Consolidated Stock and Petroleum Exchange, against the Commercial Telegram Company to prevent the removal of two stock tickers from the Exchange. The intention of Mr. Parker was to drop the suit, as a similar one had been begun by President Wilson, of the Exchange, against the telegraph company in Brooklyn. Ex-Senator Conkling appeared for the telegraph company and ex-Attorney General Russell for the Exchange. After argument by counsel the court took the papers and reserved its decision.

The Ticker War.—The claims of the rival tickers were argued before Judge Barrett, on Sept. 2, in the Supreme Court, this city. The question at issue was as to whether or not the temporary injunction granted at the instance of the Commercial Telegram Company, restraining the Stock Exchange from interfering with it in its privileges upon the floor of the Exchange (similar to those of the Gold and Stock Telegraph Company), should be continued until the suit brought to determine the rights of the rival tickers can be tried. The Western Union Company had been made a party to the suit, and General Swayne appeared for that corporation, Messrs. James C. Carter and Cass Ledyard appeared for the Gold and Stock Telegraph Company, Ex-Senator Conkling and George Putnam Smith and James E. Chandler represented the Commercial Telegram Company. Decision was reserved.

THE TELEPHONE.

The Government Suit.—The government counsel in the telephone suit are busily engaged in preparing an answer to the demurrer filed by the Bell Telephone Company in the Columbus case, and their brief is practically completed. The arguments will begin on Sept. 20, and the government's case will be represented by Messrs. Thurman, Lowrey and Chandler.

THE ELECTRIC LIGHT.

The Greensburg Electric Light Company, Greensburg, Pa., has been incorporated. Capital stock, $6,000. Treasurer, William A. Huff.

Lawrence, Mass.—Three hundred electric arc lights are being placed in position in the mills of the Arlington worsted department, Lawrence.

Miners' Safety Lamp Prize.—Mr. Ellis Lever has renewed his offer of a valuable prize for the production of an efficient electric safety lamp.

The Zanesville Electric Light Company, Zanesville, Ohio, has been incorporated. Capital stock, $25,000. Geo. R. Fox and others incorporators.

The Western Electric Light Company, Columbus, Ohio, has been incorporated. Capital stock, $25,000. Geo. L. Converse, Jr., and others incorporators.

The New York, Lake Erie & Western Railroad Company are putting in electric lights in their yard at Hornellsville, N. Y. It is claimed by railroad men that the yard is quite dangerous, and the company were resolved to obviate the danger by this method. There are some thirty miles of track in this yard.

The New Haven Electric Light Company has ordered from the Jarvis Engineering Company, Boston, the second 90 horse-power Armington & Sims Company engine, making eight of this type of engine it will use in its station. It is going to introduce incandescent lights, and also sell power from Sprague motors.

Electric Light at Teheran.—Mr. Stevens, the bicyclist, who is attempting to ride round the world, has written to a contemporary from Teheran giving an amusing account of the effect produced upon the native mind by the arc lights which the Shah has recently had placed in the square of the palace. It is the lighting up that astounds them most of all. The general conclusion is that nothing but the direct instrumentality of Sheitan could produce an instantaneous illumination of such dazzling brightness.

A New Lecture Lantern.—Professor A. Gray and Mr. T. Gray have devised a new electric lantern for lecture purposes. It consists essentially of a small Gramme motor combined with an arc lamp in such a way that the revolution of the motor moves the carbons in opposite directions, and keeps the arc sensibly constant in position. The lamp itself has several advantages, for example, the addition of condenser lenses. The distance of the lenses from the arc can also be changed. The magnification can be readily adjusted to suit the distance and size of the screen, or, on the other hand, a parallel beam may be obtained for spectrum illustration. Moreover, the image of the arc itself can be projected on the screen, to show the mode of wearing of the carbons, the effect of placing impurities in the arc, or the attraction and repulsion of currents and magnets on the arc.

Gas and Electricity in Paris.—It is reckoned that there are now in Paris 16,044 incandescent lamps and 2,225 arc or Jablochkoff lights. The *Bulletin Internationale de l'Electricité* gives an interesting analysis of the effect of this large number of lights on the Parisian Gas Company. Admitting that each incandescent lamp replaces one jet of gas, and that each arc light is equivalent to ten ordinary burners, an estimate—which our contemporary considers very moderate, and one which gas manufacturers themselves cannot regard as exaggerated—this would represent in round numbers 38,300 gas burners lost to the Paris Gas Company. At the rate of 140 litres of gas per hour, these burners would consume 5,362 cubic metres, taking them to be lighted on an average for four hours a day during the whole of the 365 days of the year. This would amount to 7,755,520 cubic metres, which at the rate of 0.30 centimes per cubic metre would put into the coffers of the company 2,326,656 francs. This sum is very considerable, but there has to be added to it what would be obtained from the sale of residual products in the manufacture of this great quantity of gas if the electric light did not exist. In the face of such facts it is not surprising that the progress of the new illuminant is attracting in an unusual degree the attention of persons interested in the Parisian Gas Company.

APPLICATIONS OF POWER.

At the Chicago Industrial Exhibition.—A model of the Enos Elevated Railroad is being exhibited at this exhibition, the Daft motors being employed on the locomotive.

Los Angeles, Cal.—The first Daft motor for Los Angeles, Cal., is nearly ready and will be shipped in a few days. There are four of these motors in course of construction.

The Merchants Electric Light Company, of Boston, has ordered a 125 horse-power Armington & Sims Company engine. The power from this engine will be transmitted over wires to run Sprague motors all over the north end of Boston. It will furnish power for printing presses, sewing machines, ventilators, fans and both freight and passenger elevators. By means of this most wonderful system attics and lofts can be made as valuable as lower floors. It is only a question of time when thousands of horse-power will be used in that city and all transmitted by wire.

M. Trouve's Electrical Boat.—M. Trouvé has lately been working very hard upon the general question of electrical navigation, and has designed several new features in this connection. His latest motor is said to develop one-half horse-power and to weigh only eight kilos; another weighing 15 kilos yields one horse-power. A speed of 15 kilometres, or over nine miles per hour, is reported to have been attained. At this speed it is desirable to have some means of heralding one's approach. M. Trouvé has therefore designed an electric siren which gives a particularly strident blast. The siren consists of two discs pierced with numerous holes, which are placed close together and rotated at a high speed in opposite directions. A blast of air driven by a circular fan is directed upon the discs, and the whole apparatus is driven by a small motor. The boat is also provided with several incandescent lamps and an arc light projector.

PERSONALS.

Mr. H. C. Adams, of Holmes, Booth & Haydens, was presented with a daughter on the 5th inst.

MISCELLANEOUS NOTES.

Logan, Kan.—The Electric Manufacturing Company has been organized. Capital Stock, $100,000. Howard Grove and others, incorporators.

The U. S. Electrical Construction Company, of Dubuque, Iowa, has been organized with a capital of $50,000. Edward T. Kein is the secretary.

Electrical Alarm Signals.—The Acme Railroad Appliance Company, Portland, Me., has been organized. Capital stock, $400,000. President, Geo. O. Hanlon, Cambridge, Mass.

Cellulose.—The usual solvent employed in the treatment of cellulose is an ammoniacal solution of sulphate of copper. It is now stated that when cellulose is employed for the filaments of incandescent lamps, it is preferable to employ as a solvent a neutral solution of zinc chloride.

To Make Bridge Jumpers Dance.—The Brooklyn Bridge police are happy. They are no longer in fear of cranks wanting to jump into the river. The life lines on the big cables have been connected with one of the electric light circuits, and, as a member of the force put it, the first man, woman or child who touches them will have to be taken to the hospital.

Permanent Electrical Staff at Sheerness Dockyard.—The workmen from Sheerness who have been undergoing a complete course of training in the electric shop in Portsmouth Dockyard will shortly return to their own yard, in order to constitute the permanent electrical staff which was ordered by the British Admiralty to be established some time since. They will be entrusted with the work of fitting the "Mohawk," torpedo cruiser, with all the necessary torpedo appliances.

Tidal Observations.—Fifteen tidal stations have been fitted up along the Scheldt and its tributaries, between Ghent and Lille, Belgium, and connected by telegraph with a central station, where the observations are registered and printed. Each station is provided with a tidal indicator and an observer. By means of an automatic mechanism, the tidal indicator transmits its results at intervals of five or ten minutes by telegraph to the recording apparatus, which in turn automatically records or engraves the height of the tide on a zinc plate. The results of four stations are registered on the same plate.

A Precursor of Earthquakes.—Those who have lived in countries subject to earthquakes state that the atmospheric conditions here have been such that in those countries the inhabitants would have known that an earthquake was impending. Mr. Thomas R. Taltavall, Superintendent of Telegraphs of the Associated Press, has spent a number of years in Spain and Portugal. During the few days preceding the recent earthquake he had frequently remarked that an earthquake was coming. He gave as his reasons for thinking thus, the peculiar steely appearance of the sky and the long continued drought. He states that in Spain those dry spells and misty, leaden mornings always preceded earthquakes.

Spiral Lightning.—During a severe thunder-storm which occurred on May 12, in the present year, M. Ch. Moussette succeeded in obtaining several photographs of the lightning. In some of these the discharge has assumed the form of an irregular spiral. In the case of two flashes which were taken upon the same plate, the first is a dextrorsal spiral, and the second divides into two branches, for which the direction of rotation is different, one being right-handed and the other left-handed. The distance between the separate turns of these spirals varies greatly in different portions of the same discharge. It has been suggested that flashes of this character are probably due to the discharge of globular lightning having a gyratory motion, similar to the effects obtained upon a smaller scale by M. Planté.

The Work of Deprez.—The Rothschilds not long ago gave M. Marcel Deprez a commission, with unlimited credit, to investigate the problem of the electrical transmission of force. He was thus enabled to make very elaborate and costly experiments, designed to show the qualities of various conductors and insulators, the economies of various machines, etc. Some of the results have already been published in technical journals, and all will soon be at the service of electricians everywhere. So far as we have observed, no remarkable discoveries resulted from this investigation, but some things have been proved or explained that were heretofore only guessed at, and there is no doubt that the experiments have been worth to the world much more than they have cost. Yet no man expecting a return in dollars and cents could have afforded to have made them. Such researches must be carried on at the expense of scientists or their patrons for the good they may do, rather than for profit. In this case the Rothschilds have made a generous gift to all mankind.—*Philadelphia Ledger.*

Terrestrial Magnetism.—The Pittsburgh *Leader* contains the following: "Professor Jean Jarentski, of Paris, who has been here examining gas wells, has gone to inspect the magnetic wells of Michigan. The theory upon which he is now at work is that at some depth there may be found a stratum of mineral which is heavily charged with magnetic electricity, which may be brought to the surface and utilized. This theory has received partial confirmation in the existence of wells in Europe and in this country. As those of Michigan are in a location which could be used, in connection with the power, to build manufactories, an essential which none of the others possess, a syndicate of Frenchmen, believers in the theory, has sent Professor Jarentski here to experiment upon the subtle force. The wells are now flowing water from the depth of 800 feet so highly charged with electricity that a knife blade or steel bar held in the water for a few moments becomes highly magnetized. The waters have become celebrated in the vicinity for their healing power when used for nervous diseases or debility. In connection with their history is the story that while under way the drillers were astonished to find that the string of tools became magnetized, and that a steel line used in measuring the depth became charged, and it was with difficulty that the well was put down to the water. The professor is confident that at some point he can find strata sufficiently charged to run mills and factories independent of steam or other forces."

SPARKS AND FLASHES.

A Dayton man went to Cincinnati, and some one who saw him and knew him went to the telegraph office and telegraphed in the Dayton man's name to his wife for $15, and got it by telegraph money order.

Extraordinary Transmission of Power.—A correspondent of the London *Electrician* writes: "I think the most astonishing thing I saw in the [Indian and Colonial] Exhibition was a dynamo which the placard stated was supplying current to drive two motors, 'one in South Africa and the other in New Zealand.'"

The Dancing Derby.—A new planchette is made in Chicago by nailing four short wooden legs under the rim of a man's hat by means of pins run through the cloth. On pieces of paper the letters of the alphabet are marked, and so are the words "yes" and "no" on separate bits of paper. Persons with mediumistic or electrical qualities derive much fun from making the hat spell out words by leaping from letter to letter. The toy is called "the dancing Derby."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the N. Y. Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Western Union, b 67⅜, a 67½.

Telephone.—Am. Bell, b 190½, a 192; Erie, b 26½, a 27; Mexican, b 1⅝; New England, b 39½, a 39¾.

BUSINESS NOTICES.

Magnetism in Watches.—

THE UNITED STATES ELECTRIC LIGHTING CO.

C. C. WARREN, 216 *La Salle Street.*
Manager Western Department.

CHICAGO, Feb. 10, 1885.

Messrs. Giles, Bro. & Co.:

GENTLEMEN: I have now been carrying my watch encased in one of your Anti-Magnetic Shields for about a year, and it affords me pleasure to state to you that notwithstanding I have been very much about dynamo-electric machines during the time named, the anti-magnetic case seems to protect the watch perfectly from the magnetic influence of the machines. I have not made any special electrical tests, inasmuch as I regard the good running of the watch as all that is necessary. I am thoroughly convinced, from the effect upon my own watch, that the case is an excellent protection, and I may almost add an absolute preventive of magnetic influence from external sources to the delicate movements of a watch. My watch is a Howard watch, and during the period of two or three years previous to encasing it with your anti-magnetic case it had varied to a very great extent, and I had it demagnetized on two different occasions. I regard your case as a complete success, and if my indorsement of same is of any value, you are at liberty to use it.

Yours truly,

C. C. WARREN, *Manager Western Dept.,*
The U. S. Electric Lighting Co.

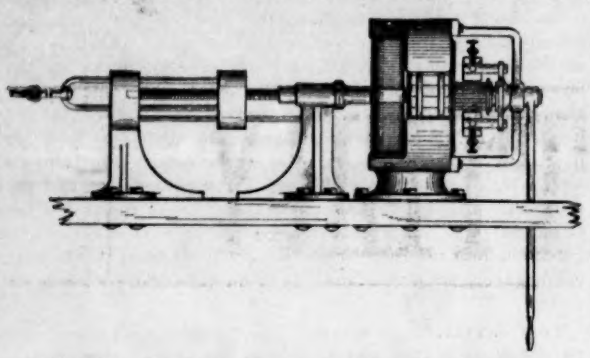
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED AUGUST 24, 1886.

347,766. Artificial Electrical Resistance; Harrold P. and Francis H. Brown, Chicago, Ill. Short pieces of metal wire are placed the one on top of the other, as shown in front and side views in the cut.

347,767. Incandescent Electric Light Hanger; Harrold P. Brown, Chicago, Ill. In the electric lamp-holder there is an inclosing case or shell, two insulating clamp-blocks, a turn-off plug having a shaft journaled on one of the clamp-blocks, and a spring-contact connected with the plug and the lamp-circuit.

347,768. Means for Storing and Utilizing Electricity on Vehicles; Charles E. Buell, New Haven, Conn. Consists



347,904. DYNAMO ELECTRIC RAILWAY BRAKE.

of a charged electrical conductor extending along the path of the vehicle, means on the vehicle for taking the current from said charged conductor, whether the vehicle be at rest or in motion, and a series of secondary batteries also located on the vehicle and adapted to be charged by the current so taken off.

347,823. Electric Pile; Jean B. Neyard, Lyons, France. Relates to galvanic elements, and has for its object to prevent the oxidation of the binding screw or screws or other connections whereby the electrodes are connected with the line-wires; and it consists in the details of constructions of the element, and more especially the construction of the inner porous cylinder and the head or cover of the cell.

347,866. Thermo-Electric Damper and Alarm; Albert M. Butz, Minneapolis, Minn. Consists in a thermostat located in two open electric circuits, one of which is closed by the thermostat when the temperature at the thermostat rises to a certain point, and the other is closed when the temperature falls to a certain point, and a spring-motor arranged in said circuits and adapted to operate a regulating valve.

347,901. Electric Railway Traveler and Switch Operator; 347,902. Electro-Dynamic Motor; 347,905. Underground Conduit for Electrical Railways; Charles J. Van Depoele, Chicago, Ill. 1. Consists of a suspended conductor, branch conductors, switches, a traveling contact upon the conductor, a flexible mechanical connection between the car and the contact, and means for rotating said connection, and thereby imparting lateral pressure to the contact and operating the switches. 2. The field magnet consists of a single iron core having a projecting body of iron extending around its central portion, a yoke secured to said projection and supporting the armature-shaft at one end, the other end being supported by a journal in the centre of the single core. 3. Consists of rigid metallic sides, central insulating supports or blocks, to which the sides are secured, and an electric conductor mounted upon the central support.

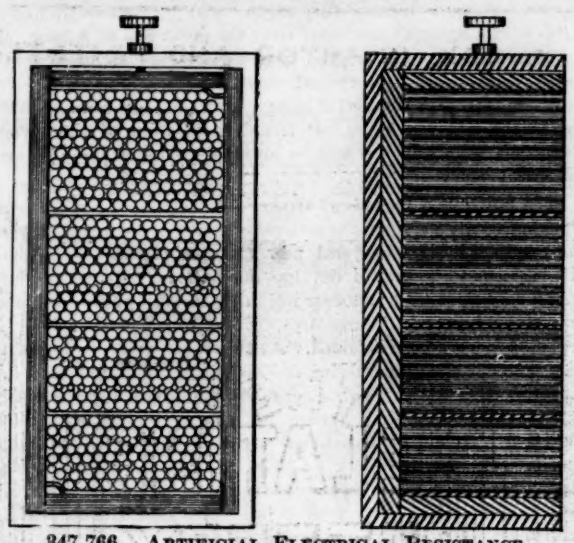
347,904. Dynamo-Electric Railway Brake; Charles J. Van Depoele, Chicago, Ill. The braking claim is for the combination, with two or more cars, of brake-rods extending from each car and mechanically connected throughout the train, a screw-shaft to which the terminal of the system of connected brakes is secured, a motor at one end of the train, and connections between the armature of the motor and screw-shaft, whereby the same can be rotated in either direction and thereby set or release the brakes, as desired. One way of carrying out the invention is shown in the cut.

347,924. Telephone Transmitter; John E. Dann and John Lapp, Houeoye Falls, N. Y. Consists in details of mechanically supporting the electrodes.

347,937. Regulator for Dynamo-Electric Generator; Rudolph M. Hunter, Philadelphia, Pa. The brushes are movable longitudinally over the commutator, whose sections have their dividing line oblique to the axis of the shaft.

347,943. Insulator for Electric Wires; John M. Leonardson, Ludington, Mich. Consists of an insulator cut away on one side and provided with a concave laterally-projecting lip, and a cam-lever pivoted to the side of the insulator, provided with a cross-arm near its free end, having hooks for engaging the wire when the wire is clamped between the cam and the concave lip.

347,964. Regulator for Electric Motors; Oliver B. S. Shallenberger, Rochester, Pa. Consists of a motor and the main coils thereof, secondary exciting coil or coils, main conductors connecting the armature-terminals of a motor with the terminals of a suitable generator, and a shunt-circuit including the secondary coil or coils and connecting the motor and the generator, the secondary coils being so wound and proportioned that any change of loss of potential in the main conductors between the generator and the motor will automatically increase or decrease the excitation of the magnetic field of the motor, and thereby maintain a constant speed of rotation of the armature of the motor under varying loads.



347,766. ARTIFICIAL ELECTRICAL RESISTANCE.

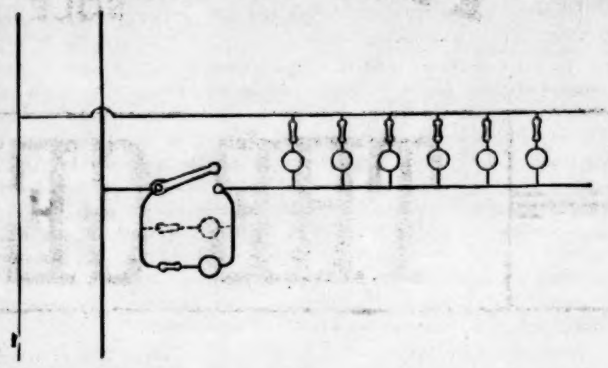
348,008. Conductor for Electric Railways; Robert L. Harris, Brooklyn, N. Y. It is composed of a metallic bar having a head with its upper surface coated with insulating material, a depending web below the head of the bar, the surface of which is exposed for the contact-maker of the traveling motor, the object being to prevent entrance of rain water.

348,045. Electrical Annunciator; Gwyne E. Painter, Baltimore, Md. Consists of an electro-magnet with a projecting core and an unpolarized armature suspended within the field of said magnet, and carrying an index, combined with a spring-retracted armature and a pin or stud attached thereto normally located between said index and core, whereby when said magnet is excited the armature and pin will be depressed by the same impulse which causes said index to swing, and at the discontinuance of said impulse said pin will assume a position on the opposite side of said index, to prevent its return to its initial position.

348,048. Fusible Cut-Out for Electric Circuit; Charles G. Perkins, New York, N. Y., Assignor to the Imperial Electric Light Co., of same place. Consists in surrounding the fusible element with an inclosing-surface of non-combustible material, and in providing a receptacle for the molten globule, which shall retain it in contact with the non-combustible material until it has become cool.

348,049. Fusible Cut-Out for Incandescent Electric Lamps; Charles G. Perkins, New York, N. Y. Consists of the combination of mechanical details of construction.

348,077. Telephone; Thomas A. Watson, Everett, Assignor to the American Bell Telephone Company, Boston, Mass. It consists in connecting the armature of the magnet thereof with a diaphragm by a mechanical device for increasing range of movement, by means of a simple lever, the connected



348,155. NIGHT LAMP FOR ELECTRIC LIGHTING SYSTEMS.

armature and diaphragm taking the place of the usual diaphragm, which itself forms the armature of and is vibrated by the magnet.

348,114. Electrode for Telephone Transmitters; Thomas A. Edison, Menlo Park, N. J. A piece of textile fabric is impregnated with carbon.

348,121. Magnetic Separator; George A. Gilbert, Lincoln, Ill. The cylinder consists of a single sheet of steel permanently magnetized and joined at its edges, in combination with a non-magnetic strip interposed between said edges, a frame in which said cylinder is suspended and mechanism for revolving said cylinder.

348,125. Night-Lamp for Electric Lighting Systems; John W. Howell, New Brunswick, N. J., Assignor to Charles S. Van Nuis, same place, and Dyer & Seely, New York, N. Y. Embraces an electric lighting-circuit and incandescing electric lamps in multiple arc therein, and connections for throwing one or more of such lamps from multiple arc into series with the other lamps, whereby a night-light will be produced.

348,134. Receiving Telephone; Orazio Lugo, New York, N. Y. He combines with the receiving hard telephone box a magneto and a condenser speaking telephone. See E. W., Sept. 4.

348,139. Telephone Switch and Circuit; Edwin Pope, Quebec, P. Q., Canada. The system embraces a central office connected by a given number of wires with a larger number of stations, two or more of the wires being taken to each station, in each station an individual coil operated only from the central office, and a switch, connecting at will subscribers' instruments with a particular wire, and by joint action with the central office connecting such instruments with any wire of the system.

348,153. Night Lamp for Electric Lighting Systems; Richard M. Dyer, New York, N. Y., Assignor to John W. Howell and Charles S. Van Nuis, New Brunswick, N. J., and Dyer & Seely, New York, N. Y. The object is to be able to turn out the regular light in a store, for instance, and leave the night lamp burning. The system is shown in the cut.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

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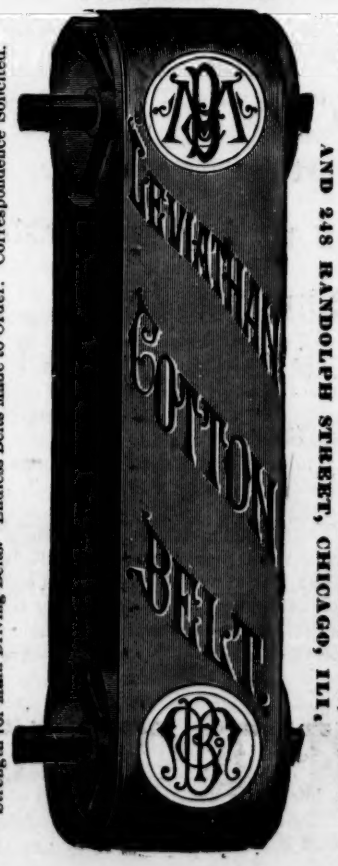

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